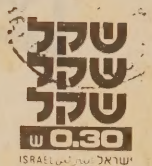
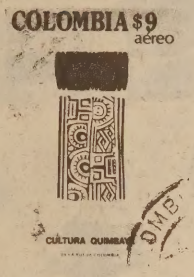
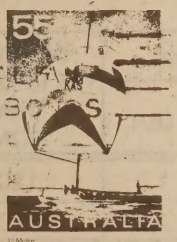
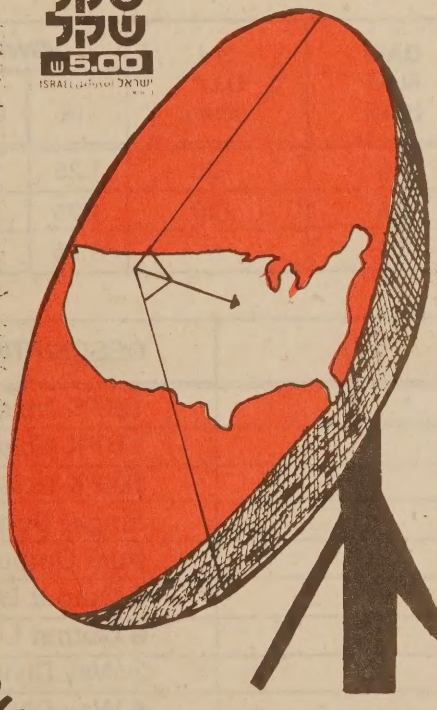
SATELLITE TVRO DIGEST









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MARCH 1982

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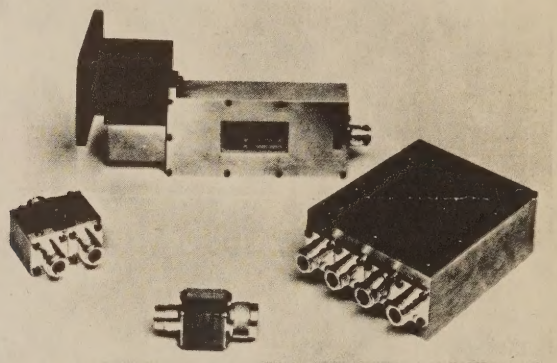

MODEL NO.	GAIN (db) MIN.	GAIN FLAT (± db)	3rd O.I.P. (dbm)	VSWR		DC PWR. +15 to +28VDC (mA) NOM.	OUTLINE DRAWING
				IN	OUT		
C40115-XXX	50	0.5	+20	1.25	1.5	120	C731-I
C40152-X	20	0.5	+20	1.75	1.5	70	C420-X
C4010-X	—	0.1	—	1.25	1.25	—	C400-X

MODEL NO.	DESCRIPTION
C40115-120	120°K Noise Temperature LNA
C40115-110	110°K Noise Temperature LNA
C40115-100	100°K Noise Temperature LNA
C40152-1	Single Output Line Driver
C40152-2	Dual Output Line Driver/Divider
C40152-4	4 Output Line Driver/Divider
C40152-8	8 Output Line Driver/Divider
C4010-2	2 Way Divider
C4010-4	4 Way Divider
C4010-8	8 Way Divider
C40100	DC Block (Bias T)

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SATELLITE T.V.R.O. DIGEST

M A R C H 1981 C O N T E N T S VOLUME 1 NUMBER 4

F E A T U R E P A G E

T E R R E S T R I A L N O I S E 3
AK4H tells how to recognize and beat MA BELL in your system.

C O M P U T E R C O R N E R 6
The SATELLITE AIMING PROGRAM is reprinted.

P U B L I S H E R S C O M M E N T 8

7 0 Mhz F I L T E R S 9
Mike Feher N4FS shares MORE of his experience.

E D I T O R I A L 10
This space belongs to that salty engineer. John Rohner.
This month he speaks of EIA, Manuals, Electronic rotators etc.

B A S I C P R O J E C T 12
A remodulator based on the Motorola MC1374 IC.

A D V A N C E D P R O J E C T 16
The Image reject single conversion downconverter.

L E T T E R S 31
Answers to letters received and maybe some helpful tips.

N E W S 36
News of satellites and related industry happenings collected from the wire services and the myriad of trade publications we get each month.

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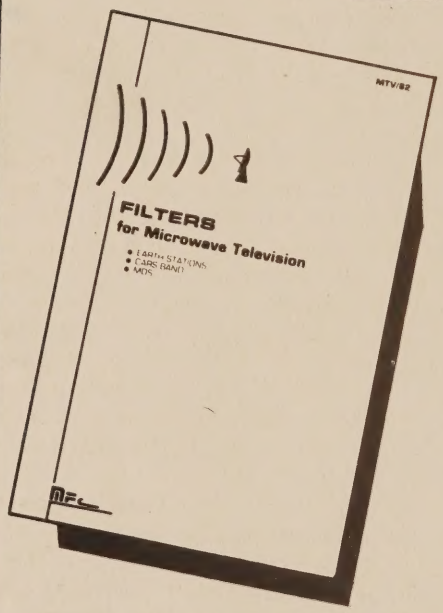
EARTH STATION OWNERS & DEALERS:

You've got terrestrial interference...
We've got filters!



The concrete under your new earth station isn't hard yet, but you've got trouble already—unwanted microwave signals are destroying your picture. Your customer is throwing tantrums, and you have two choices: Tear it down and eat the installation costs, or filter it.

We can help. Call us and we'll send you MTV/82, which tells how to eliminate terrestrial interference on earth stations and lists a complete line of filters designed and tested for this purpose. Created for effective use by novice and experienced earth station operators alike, MTV/82 explains each type of interference, describes the symptoms and recommends specific filters to solve your specific problems.

Products include:
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- *coax adapters*
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Call or write today and we'll also send you FG/82, *"Earth Stations & Terrestrial Interference: A Filtering Guide for the Installing Dealer."*

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OVERCOMING TERRESTRIAL INTERFERENCE

By Bill Lambert AK4H

About a year ago I put my own TVRO into operation. After getting over the thrill and excitement of receiving "pictures from space" I began to realize that things were not as they should be. After scientific observation and evaluation I concluded that my pictures looked like crap.

Before discovering the cause of my troubles, I blamed my receiver, a Howard-Coleman with Simpson discriminator. The problem appeared to be spurs from the receiver sitting on top of certain transponders. These spurs would completely block out the picture, and at other times the picture would be full of sparklies.

Eventually, I discovered that my problems were external. If I disconnected my LNA B plus, changed polarization, or moved the dish to another satellite the spurs disappeared. Further confirmation was made when I substituted a Microdyne receiver for mine. Same result. I was being zapped with interference.

After studying these spurs, or interfering carriers, closely I noticed that when they were at their worst, I could detect what sounded like single sideband transmissions mixed in them. I connected the baseband output of my TVRO receiver to my ham receiver and started tuning. To my amazement I started hearing what were obviously telephone conversations. I had identified the source. MA BELL!!!

Terrestrail microwave interference problems of the Ma Bell type can be solved by one or more of the following: Persuade the phone company to stop interfering; Mover; Attack the problem with your own bag of tricks. Forget trying to get Ma Bell to shut down and its just not a smart thing to move just to watch TV. Your only reasonable hope is to fight the interference.

In my case the source of the interference was a tower about five miles away and directly in line with F1. A ridge of trees blocked the view of the tower but not the crud coming from it.

I drove over to the microwave installation to check it out, found it to be locked up tight. Days passed and I would ride by every day until finally I spotted a car parked inside the fence with the gate open. I turned in and expecting to be run off, walked up and banged on the big steel door. The man asked me in and when I told his of my problems offered to show me around.

He explained that the installation with its massive horns 160 feet in the air was a telephone repeater feeding another repeater about 35 miles away. The whole country is criss-crossed with these things so the potential for interference is greater than you might have guessed. The frequencies utilized are only 10 mhz off center above and below the satellite transponder frequencies. At this installation sixteen transmitters with a power of 35 watts each were being used. When I noticed the frequency of each transmitter marked on its waveguide it became evident that these things were causing me grief. I cursed them all.

Armed with newly discovered information and knowing that this thing would still be here 20 years from now, I set out to defeat the interference. After all its only a matter of keeping Ma Bell out of my feed while letting the "bird" in. Through extensive experimentation I have tried a number of "fixes" with varying degrees of success. If you have problems with this type of interference I have some suggestions that might help.

First of all, determine that your problem is the result of terrestrial microwave interference. Depending upon the degree of severity, some of the symptoms of terrestrial interference are: completely blocked out transponders, increased sparklies on certain transponders while others are perfect, jitters, or unstable lines with flashing in the picture. You may or may not hear weak single sideband transmissions underneath.

A ringing sound may be heard on some carriers. Swing your dish up to Comstar and look at the non-video transponders and you will see one possible example.

The degree of interference depends on the time of the day and day of the week. The carriers are on continously, but the width of them is directly related to the modulation index at work. The more telephone traffic, the wider the interfereing carriers and their sidebands are. Thus weekends are heaviest. In addition this junk appears to propagate much like a two meter inversion. It can be tough on summer evenings or when it is very foggy. I've noticed it pop in and out during rain storms.

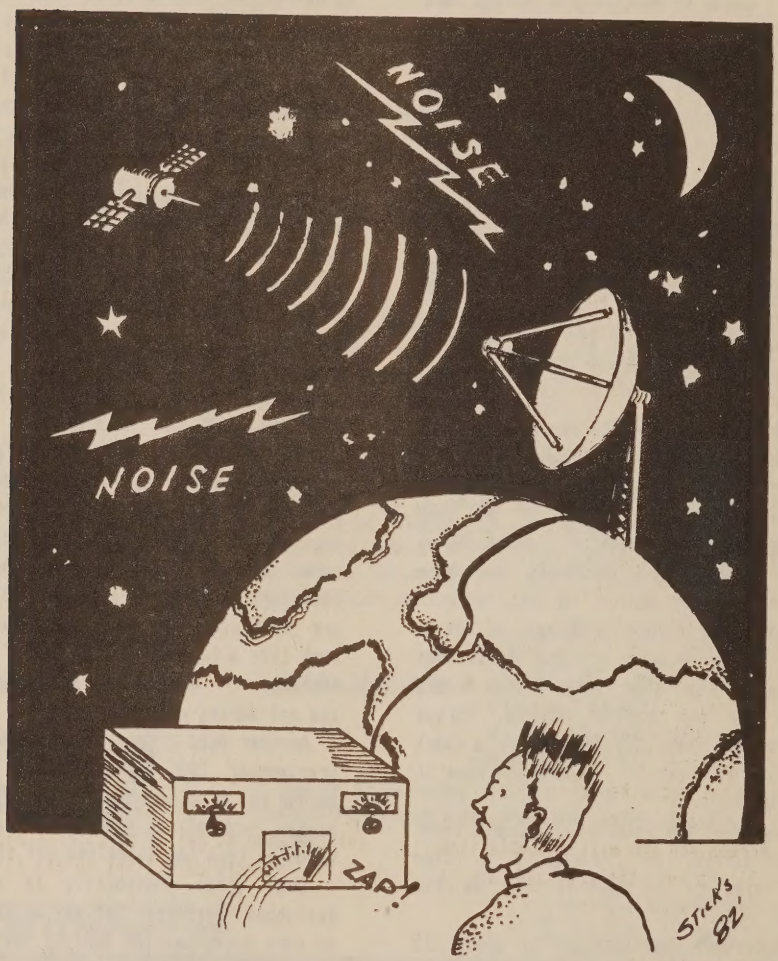
Another dead giveaway when using a tuneable receiver is a transponder that looks terrible, yet the S meter reads high enough for a noise free picture. The meter will rise much higher suddenly as you tune off center indicating something stronger than the satellite off its center frequency.

One other possibility is video traffic instead of telephone traffic. You may be able to see another picture, or sync bars, beating against the satellite This is assuming that your feed is properly nulled against opposite polarization on 24 transponder satellites.

Often you will spot the offending carrier "all out in the open", providing that there is no operating satellite transponder adjacent to it. In this case you can connect the baseband output of your TVRO receiver to the antenna input of a Ham or communications receiver and start tuning around 4 mhz and down in the S.S.B. mode. (Your regular antenna must be disconnected from the communications receiver while running this test). Keeping the TVRO receiver on the carrier, you will hear a mixture of heterodynes and S.S.B. trafffic. These symptoms leave little doubt as to what is going wrong when your system is being molested by Ma Bell. Depending on your specific case, getting rid of the interference can be simple task or a nightmare. In most cases you will be picking up scatter or reflections rather than the direct beam. It can hit you from the sides

FG/82

EARTH STATIONS & TERRESTRIAL INTERFERENCE



A Filtering Guide for the Installing Dealer

by Glyn Bostick
President & Chief Engineer,
Microwave Filter Company, Inc.

This little book can help you understand and fight MA BELL if she's interfering with your system. I highly recommend it.

Contact: MICROWAVE FILTER COMPANY
6743 KINNE STREET
EAST SYRACUSE, NY. 13057
(800) 448-1666

at different angles or dead boresight.

Since you are probably being troubled by reflections and scatter, you can usually move your dish a few feet or even inches and eliminate the interference altogether. If your dish is bolted to the concrete, you may have problems accomplishing this feat. However, this is the first and possibly best, thing to try. In most cases you'll get rid of the stuff. A trailer mounted dish moved short distances at a time while still on the bird will reveal that there are peaks and nulls all over the place. Find a good deep null. Once you have found this clean spot, leave the dish on the trailer at this spot for a few days to make sure the stuff doesn't move around and zap you again. When you are sure, then you can pour a new pad.

If you are unable to find a good spot, it is time to try blocking the interference out of your feed. By identifying the direction the stuff is coming from, you can erect small screen in its path and knock it out. If you are not sure of the direction, take your LNA and feed off the dish and walk around with it pointing in various directions and looking at the TV, while someone tunes the receiver. When you hit the mess it will be evident on your TV screen. This will tell you what general direction you start with the screens in order to block out Ma Bell. The problem may require screen as small as a pie pan or as large as your house. A good size to start with is a good metal one like those on your windows. Walk around in the path of the interference in front of the dish with the screen and you will probably find a spot where the screen blocks out the crud and leaves you with good pictures. Erect a permanent screen or shield in that spot.

In my case I was using a 13 foot Starview warped disaster. If your dish is warped you have the possibility of more paths of interference hitting your feed. By changing the focal point slightly, it is possible that you can eliminate some of the interference; unless your dish is so good that changing the focal point any at all causes the picture to go down. I could move mine a foot and help some. I later switched to a very accurate 16 footer and that helped considerably. Another successful method is to put the dish behide a hill or ridge and looking up over it at the bird. The hill or ridge would serve as a shield.

In cases where shielding and dish placement doesn't eliminate the interference, there is still an answer: an article in the August 81 CATJ, page 24, by Glyn Bostick alerted me to the availability of traps to notch the interference out. A call to the good folks at Microwave Filter Company had the notch filters in my hands in a week. These filters are without a doubt worth ten times their weight in gold. I believe you could sit and watch the PTL CLUB using these filters with your dish 100 feet in front of Ma Bell' horns. There is a slight drawback. A part of the satellite passband is notched out but bear in mind, the filters could mean the difference in your system's working or not working. You'll enjoy your system more if it works.

A brief description of how these filters work is in order. The terrestrial interference carriers are offset from the center of each transponder plus or minus 10 mhz. These carriers retain their 10 mhz transponder plus or minus 10 mhz. These carriers retain their 10 mhz relationship in the down conversion process. Therefore if your low I.F. is 70 mhz, the carriers show up at 60 and 80 mhz in your I.F. passband. The sharp notch filters in the line from your down converter to your I.F. strip will suck Ma Bell right out of the picture. In severe cases, your LNA and down converter can become over loaded. Special filters are available for this condition.

Since I live so close to Ma Bell's site, I am using a combination of screen hills, and filter to keep the ol' girl out. Most of the time, the screens and hills do the job 100%. Once in a while, unusual weather conditions cause the interference to get by my barrier and I must switch filters.

The effects of filters on the picture varies on the type of TVRO receiver you are using with PLL's looking a little worse. On program material if you are well out of the sparklies, you will not notice any degradation. On saturated color bars some degradation will be evident. Picture quality is affected a little more if you are at or slightly above threshold, but still very watchable. In my case a transponder completly wiped out by interference can be restored to 90% of its uninterferred with state.

Because of the slight degradation of picture quality when using filters, I have wired up my system so that either the 60 or 80 mhz traps can be switched in separately or together or out as conditions warrant.

One other little trick I played with was to reduce my I.F. passband to 18 mhz. This got most of the interference but the picture is pretty lousy at this point. I hope my experiences will be of benefit to you if you are having problems of this type. In most cases, dish placement and screens will do the job. Filters will do it if all else fails.

```
10 REM COMPUTE SATELLITE TVRO ANTENNA AIMING COORDINATES
20 REM CONSTANTS - RS IS IN NAUTICAL MILES - USE 42166 FOR KM
30 K=6.61 : PI=3.1415927# : RS=22766
40 REM BASIC COMPUTES IN RADIANS SO THESE ARE THE CONVERSIONS TO DEGREES
50 DEF FNRAD(X)=X*PI/180
60 DEF FNDEG(X)=X*180/PI
70 DEF FNACSN(X)=-ATN(X/SQR(-X*X+1))+PI/2
80 REM INPUT ANTENNA COORDINATES IN DEGREES (99.99) NO MINUTES/SECONDS
90 INPUT "ANTENNA LATITUDE ";AD
100 INPUT "ANTENNA LONGITUDE ";HD
110 LPRINT CHR$(12)
120 PRINT "AIMING CHART FOR LATITUDE ",AD,"  LONGITUDE ",HD
130 LPRINT "AIMING CHART FOR LATITUDE ",AD,"  LONGITUDE ",HD
140 PRINT:LPRINT
150 PRINT "SATELLITE","LOCATION","BEARING","ELEVATION","RANGE"
160 LPRINT "SATELLITE","LOCATION","BEARING","ELEVATION","RANGE"
170 PRINT:LPRINT
180 REM I = NUMBER OF DATA ENTRIES (NAME,LOC) TO BE PROCESSED
190 FOR I=1 TO 16
200 READ SN$,SL
210 W=FNRAD(SL) : H=FNRAD(HD) : A=FNRAD(AD)
220 L=(H-W)
230 D=FNACSN(COS(A)*COS(L))
240 REM C = TRUE AZIMUTH
250 C=FNACSN(-TAN(A)/TAN(D))
260 IF L<0 THEN C=2*PI-C
270 CD=FNDEG(C)
280 REM EL = ELEVATION BEARING
290 EL=ATN((COS(D)-(1/K))/SQR(1-COS(D)*COS(D)))
300 Y=FNDEG(EL)
310 REM RG = RANGE TO SATELLITE
320 RG=RS*SQR(1-(2/K)*COS(D)+(1/(K*K)))
330 PRINT SN$,SL,CD,Y,RG
340 LPRINT SN$,SL,CD,Y,RG
350 NEXT I
360 END
370 DATA SATCOM I,135,SATCOM IIIR,131,COMSTAR I,128,WESTAR II,123.5
380 DATA SATCOM II,119,ANIK III,114,ANIK B,109,ANIK II,107,ANIK I,104
390 DATA WESTAR I,99,COMSTAR D2,95,WESTAR III,87,SATCOM IV,83
400 DATA INTELSAT III,34,INTELSAT II,29.5,INTELSAT I,24.5
```

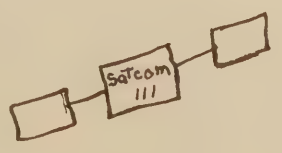
AIMING CHART FOR LATITUDE 41.1 LONGITUDE 91.2

SATELLITE	LOCATION	BEARING	ELEVATION	RANGE
SATCOM I	135	235.569	25.073	21091.7
SATCOM IIIR	131	231.726	27.6774	20961
COMSTAR I	128	228.693	29.5516	20869.3
WESTAR II	123.5	223.88	32.2113	20742.8
SATCOM II	119	218.731	34.6555	20630.5
ANIK III	114	212.597	37.0687	20523.5
ANIK B	109	206.031	39.1058	20436.2
ANIK II	107	203.29	39.8022	20407
ANIK I	104	199.065	40.7082	20369.5
WESTAR I	99	191.771	41.8227	20324.2
COMSTAR D2	95	185.769	42.3348	20303.7
WESTAR III	87	173.626	42.2993	20305.1
SATCOM IV	83	167.636	41.7526	20327
INTELSAT III	34	112.96	15.7189	21590.2
INTELSAT II	29.5	109.492	12.436	21774.5
INTELSAT I	24.5	105.807	8.74205	21986.6

I am constantly hearing people ask for aiming co ordinates on the Ham net. This program was first let out for publishing in 1979 to Mr. Cooper. I have updated it to contain the new IIIR and IV SATCOMs.

It will run on any system with Microsoft Basic. It may have to be adjusted for other Basics. It will run on TRS-80 type computers. If you don't have a printer take out the LPRINT statements.

This is the program most of the people who ask you to pay are running to provide the data. As new birds go up the DATA can be expanded to include them.



PUBLISHERS COMMENT ! ! !

Usually, I resist any temptation to mouth off in print. This is, in small part, reverence for the written word and in LARGE part paranoia!

Anything published and circulated had better be well "thought-out" cause taking it back is about as feasable as telling a woman in labor to " hold the phone ".

This month I found myself reflecting on the demise of the corporate entities of two brilliant , creative men ; Sir Freddie Laker and John P. Rohner.

Once again history (repeating itself) has not been kind to the dreamers, that hardy breed of human beings with the perseverance and just -- plain GUTS to even ATTEMPT to breath life into their visions.

After overcoming every conceivable obstacle in order to make things come together, both have received the grandly backhanded compliment of having everyone else in the business suddenly copying what "couldn't be done"! Both also have an incredible optimism, that if missplaced, can be a fatal flaw in business, especially in this volatile economy we are currantly experiencing.

I see sort of caterpiller / butterfly analogy here; The lowly caterpiller driven by some instinct to work like hell toward a future goal which only he can see. He prepares the ground work, fight the day-to-day battles to beat off predators. Metamorphosis complete, he emerges, finally as the butterfly with beauty so obvious as to suddenly attract everyone's attention. Along with the possibility of gaining a mate, comes that of being set upon and crushed by myriad creatures with varying intentions.

Oh well, enough non-technical fluff. Thank you for support and good luck to you all with your projects and your DREAMS !!

G.L. Rohner

A FAMILY OF 70 MHz BANDPASS FILTERS

By M. B. Feher N4FS

A set of elliptic bandpass filters are presented whose 1 dB bandpass response can be selected from 5 MHz to 30 MHz in increments of 5 MHz. All of these filters are centered at 70 MHz and have the same shape factor 30 dB down from the passband. Input and output impedances are 50 ohms. Figure 1 shows typical frequency response of the filters. The filter itself is shown schematically in figure 2.

Table 1 has all the element values listed to build any of the filters. The values are in pico-farads and micro-henries.

For TVRO applications two of these filter sections can be cascaded to make an excellent IF amplifier. A 1.76 dB S/N improvement can be realized by using a 20 MHz filter versus a 30 MHz one. In my personal system the bandwidth is switch selectable and I cannot discern any picture quality degredation by using a 20 MHz wide filter.

The values are critical and typically when I build these filters. I wind the inductors and measure the capacitors until I get what I need. Special care has to be taken to minimize the lead length of the capacitors since they could become part of the total series inductance. Also the inductors used should have relatively high Q with small distributed capacitance or high self resonance. Elliptic filters of this kind offer the steepest rate of attenuation for the same number of components over any of the other classical filter designs.

If an impedance other than 50 ohms is required then the new inductor values are Lnew = Lold * Znew / 50 and the new capacitor values are Cnew = Cold * 50 / Znew.

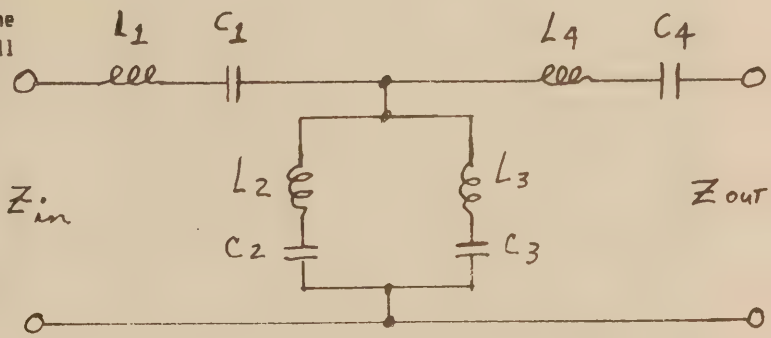


FIGURE 2.

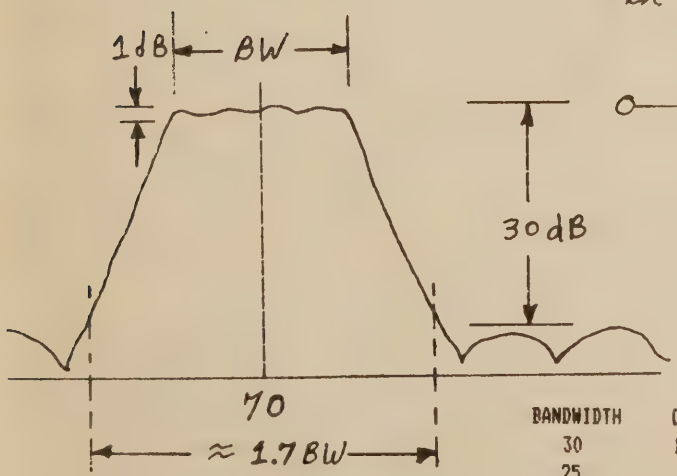


FIGURE 1.

BANDWIDTH	C1	C2	C3	C4	L1	L2	L3	L4
30	11.5	44.3	19.2	11.5	0.47	0.28	0.12	0.47
25	9.4	35	17.3	9.4	0.57	0.31	0.15	0.57
20	7.4	26	15	7.4	0.71	0.35	0.2	0.71
15	5.5	18.3	12.1	5.5	0.95	0.43	0.29	0.95
10	3.7	11.5	8.7	3.7	1.4	0.6	0.45	1.4
5	1.8	5.4	4.6	1.8	2.9	1.1	1	2.9

TABLE 1

EDITORIAL

I am going to start this month with some news that I would rather you got from me than on the rumor mill.

On Febuary 26 my company, Rohner and Associates, was dissolved. It wasn't the fault of the receiver design but bad management by one who should stick to engineering.

I made the typical mistakes. I started out way under capitalized. I hired my Brother in law and my sister, who I finaly asked to get their drugs and persons out of the company. I failed to sue Mr. Cooper until he moved his company out of the country. I was too liberal in my repair and updating of user messed up units. Mr. Cooper will now have to find someone else to lie about and use as his goat.

I will continue to support the units in the field. These people, about 800 of them, like their units. And they deserve all the support they gave me.

So now I'm an employee. I write for this magazine and hope I can continue to deliver projects and information that will update and challenge you to do something or enhance your understanding within our field.

Yes I'm bitter as hell about the money I've lost. That won't go away very fast. But I'm going to grit my teeth and say no more about it.

Fact is the girls who run Advanced Communications Engineering, for whom I consult, have had me update the old design for them and they have repackaged the receiver in a better looking case. I must admit they have good taste. You'll find their ad replaces mine.

Actually I can't say I am unhappy about getting out of the production and sales area. I am now free to work on projects that have been sitting on the back burner because of lack of time.

For instance, I am working on three new manuals which will be out in about a month. One tells how to build a "modern" receiver, one is a "cookbook" of useful circuits and stuff and the last one deals with the questions newcomers have to face before deciding what and how to go about getting started. I figure that the knowledge I've accumulated should be useful to someone.

Anyway you got the story from the horses mouth.

On a lighter note I am poling manufacturers to find out when and where they would like to have a show. I figure it's about time they had some say in where and when the next show should be. Quite a number of them are upset about the HORROR in Anaheim. And they were promished a show back east, in Ohio, and that one is going to Texas again and got moved up by two months also.

Also, since the Cooper shows are doing so badly, I see that SPACE, remember, the ones that don't have to refund your money if you overpay, is going to put on a "Space Trade Show" in Omaha the second week of August. Back again to Omaha, Nebraska.

The big news for us as an industry is: The Electronic Industries Association, EIA, has asked all interested manufacturers to join them in a conference of the Satellite Communications Section in Washington, DC March 30 th. If your a manufacturer and do not have complete information on this meeting be sure to call and get it from me. The EIA is the TRADE organization that represents such companys as Scientific Atlanta, IBM, RCA and all of the rest. It is about time that we became, or were allowed to become, members of this powerful organization. They also set standards, RS 232 being an example, that all within the industry can help to set and work under, wouldn't it be nice to have standard downconverter specs so any downconverter could be used with any receiver for example. I will report on the meeting as I have been asked by ACE to represent them.

Back to the matters at hand. We have some interesting add ons coming in the next few months, see what happens when I get loose. We will be presenting a push button, up or down, digital readout channel selector, a Cable quality remodulator that you couldn't buy for less than a thousand dollars, a bar graph readout to liven up your front panel, wireless remote control so you don't have to leave that armchair and a new receiver that will produce the same effect as if you had cable.

There are several people working on articles to explain how to build lightweight parabolic dishes. We'll be presenting a digital read out auto positioner for polar mounts. And in a project you may consider off-beat we are going to present a programmer to program the on board EPROM on the 8648 microcomputer and how to put it to work, including programs and how to program this usefull little monster. Think what you can do with a computer in your receiver. Particularly if HBO scrambles digitaly, which is the rumor. So tie your hats down folks there is a crazy engineer loose.

By the way if you have something that you think would be of interest to the group let me know I just might do it or have it hanging around. You never can tell unless you ask. I try to listen to the guys, sorry Rita, on the net to see whats of current interest.

As soon as I get holes in the PC boards I will be reviewing what looks like an outstanding receiver pc board set from Ken Rae. Yup I mentioned him last month also.

Ray Maxfield has a "fix" that seems to work for 564 type PLL receivers. At pin 4 of the 564 put a 10 uh choke in series with a 1 uh capacitor in series to ground. This slows down the lag time and smooth out the PLLs response curve at high, saturated, colors. Pin 2 should be biased harder, a 2 K to +5 if using 5 volts, YES it works ok at 5 volts as Automation Techniques will show you, If using the +12 volt supply try about 5.6 K. Also you might try hardening pin 9 with a 1.5 K to +12 volts. Several of the Hams on the net have tried this with good reports so far. I'll update you if anything else works.

It has come to my attention that no one seems to have heard of California Amplifier, see their ad. They make an extra good LNA. But because they are not a "household" word nobody seems to know it. I have used them and in an upcoming article will introduce you to the smallest and newest maker of the LNA. I like what I have used so far as well as any. They also seem to provide a flatter response, but I will have to do some further tests to say that for sure, they won't.

I was going to wait until I got a chance to test both the Luly and Tri Star units side by side before I sent in an article about their relative merits. However, I have not

been able to obtain one of the Luly units so look for a test report on the Tri Star in one of the next magazines. So far the Tri Star unit, which comes complete with its own "FRESNEL" type feed horn, has gotten rave reviews from all who are using it that I know about. One ham has said he wouldn't trade his for anything, any other maybe. I wonder if you knew that the Tri Star came equipted with a feed horn. You know when you cost out the feed horn and the rotator the cost of the GYROTOR doesn't seem like so much, particularly considering the advantages.

Dave Yanko, at Tri Star is also developing a new casegrain system designed around a special parabaloid type dish, which is shaped to use the casegrain system as opposed to prime focal. According to Dave the dish and casegrain system must be designed to work with each other for optimum results. More as this develops.

I have asked Dave to provide an article on how the "FRESNEL" feed horn differs from the "SCALAR" type. One thing I've noticed the "FRESNEL" seems to be about 1 db more efficient than the best "SCALAR" type, Chapparel, and more than 2 db better than the Appolo. Thats a very efficient design. It should be interesting to see the design differences. The physical differences are that Daves horn is not flat across the back but rather slightly cone shaped and the separaters, inside, also fall away at the same rate. We all should by now have heard about Daves' "discovery, and Chaparrels copy, of the round spherical feed horns and how efficient they are, if tuned properly about 1 foot further out than the square type.

John Yurek, the REAL first private earth station pioneer, is also going to start submitting articles for your perusal. The only caveat being that all letters to John will be channeled thru the magazine. The reason for this is John has a large business in mail order software and would appreciate the mail arriving in one group so as to not get screwwed up with the mail that pays his bills. I hope we can all be gentlemen, and you to Rita, and do this one favor for him. He has mentioned as one of his first contributions a way to make a low cost screen wire type parabolic. I think he said it uses conduit and is centered on an old Volkswagen wheel as the hub. John also has many things that he has learned since he first built his station in 1972. I hope you will join me in welcoming the true pioneer in his first article upcoming.

There was lots of talk about an article in "73" magazine which used a Magnum oscillator and mixer to convert directly to 70 Mhz. Unfortunatly the circuit is not one of the Image Reject type, like the one in this magazine this month. I want to caution anyone doing it this way, or considering it, to reread the article on the downconverter in this issue and the "history" in the November issue. Pay close attention to what happens to the Carrier to Noise ratio with the introduction of the image in the output. Steve how could you let them do this? I doubt if you had any chance to comment on the article so I shouldn't ask.

I am finishing up the breadboard for a new LSI CMOS chip that George is laying out. Yes it will be on one IC, its amazing what can be done with some of these, design your own, type chips. This chip will input an up, down and polarity pulse and provide a binary output, to decode to set the transponder voltage selection, and a multiplexed 7 segment drive to light the channel indicator readouts. What this will give you is push button up or down transponder selection with digital read out. Add one more IC and you will have remote control selection with digital readout. Sound exciting, it is. It will replace about 8 ICs needed to do it now. I will convert the Gate logic of the bread board to the MSI IC board in a few months, to drive the logic board from last month. Then we will add this LSI to the remote control IC to replace that with Infrared, wireless, remote control. We are also working to put the linear functions into LSI form along with the digital dicriminator. If George can condense these onto LSIs it is possible that a complete receiver could be built with about 4 ICs. It just might be possible to build the whole receiver, from 70 Mhz to video and audio, in a cigarette package.

You might also note that Advanced Communications Engineering has expanded its kits offerings. Many years ago I started with Double conversion 564 type receivers. They have resurected these oldy but goody boards. Of particular note is the First mixer board. Add the 8240, or equiv., and this board replaces the expensive diode ring mixer and very inexpensivly. It also has less loss. The 900 Mhz IF and 2 nd converter board has the 900 Mhz filter and a 5121 amp. This provides 25 db gain after the 3 db for the first mixer is taken out. This signal is then feed to the diode ring type mixer for conversion to 70 mhz. The second LO is a home built, about five bucks worth, so you won't need the high priced MIC type. This oscillator was one of the first things Cooper published of mine. Its a very durable and useful oscillator and will be published in an upcoming magazine. The Block Front End is a mixer with an on board 5121 for use in block conversion systems at the antenna. The SAA is my good old audio demodulator, used by Cooper in his Molnia receiver and also detailed in his operations manual. It was the first to use the 3065 type IC. You can check out the others.

Speaking of Coopers Operations Manual. As soon as I get done laughing I'll write a proper review. I must admit it is nit quite as bad as the one I did last month and is far above the "BUSINESS" manual, this one's the biggest ripoff of the century next to SKYSCAN.

I would like to thank you for your patience with the disasterous mailing of last month. We have changed post offices to see if we can speed it up some.

Oh, one last thing we have changed our printer. We are now able to provide some color on the cover. We hope it won't shock you too bad. This month the girls got hold of the cover and have mounted some of the stamps, from subscribers, from around the world. They didn't use all the interesting ones we have gotten but some.

Also Rita haven't heard you on the net lately. Been sick? Or did we scare you away?

Well my ears are getting tired, these quad headphones get heavy, and it is coming up one 3 am. Must be time to go see ya next month.

Good luck.

LINEAR ONE CHIP REMODULATOR REPLACES THE AZTEK

The fact that Motorola's MC1374 chip has both frequency and amplitude modulation and oscillator functions simplifies the design of a television modulator. The device is ideally suited for applications using separate audio and composite video signals that need to be converted into a high quality very high frequency TV signal.

The am system of the 1374 is a basic multiplier combined with an integral balanced oscillator that is capable of operating at a frequency of over 100 megahertz.

The FM oscillator modulator is a voltage controlled oscillator that exhibits a nearly linear output frequency versus input voltage characteristic.

This characteristic provides a good FM source with only a few inexpensive parts (no varactor is necessary). The system has a frequency range off 1.4 to 14 MHz and can produce a +/- 25 kilohertz modulated 4.5 MHz signal with only 0.6% total harmonic distortion.

CIRCUIT DETAILS

Fig. 1 is the schematic diagram of this application. Fig 2 is PC board top and Fig 3 is the PC board bottom.

The AM output for a complete TV modulator circuit is taken at pin 9 through a double pi low pass filter with the load (R1 = 75 ohms) connected across pins 8 and 9. Access to both (video and audio) inputs enables the designer to separate video and intercarrier sound sources.

The gain adjustment resistor, across pins 12 and 13, is chosen in accordance with the available video amplitude. By making this around 2 (peak video) volts / 1.15 milliamperes, a low level 920 KHz beat is ensured. To keep the background noise at least 60 decibels below the standard white carrier level, the minimum peak video should be at least 0.25 volt.

The oscillator for channels 2 and 5 uses a parallel LC combination from pin 6 to pin 7. For this configuration, the value of coil L1 is kept small and the capacitance large to minimize the variation due to the capacitance of the MC1374 chip (approximately 4 picofarads).

Sloppy wiring and poor component placement around pins 1 and 11 may cause as much as a 300 KHz shift in carrier frequency (at 67 MHz) over the video input range. This frequency shift is due to transmission of the output radio frequency to components and wiring on the input pins. A careful layout keeps this shift below 10 KHz. The video signal and the corresponding modulated RF output have a differential phase error of less than 2 degrees and differential gain distortions of 5% to 7%.

The FM systems is designed specifically for the TV intercarrier frequency of 4.5 MHz for the U.S. and 5.5 MHz for Europe. The FM system's output from pin 2 is high in harmonic content, so instead is taken from pin 3. This choice sacrifices some source impedance but produces a clean fundamental output, with harmonics decreased by more than 40 DB.

The center frequency of the oscillator has approximately the same resonance as L2 and the effective capacitance from pin 3 to ground. In addition, by keeping the reactance of the inductor at a point between 300 and 1,000 ohms, the overall stability of the oscillator is ensured.

Biasing the audio input pin 14 at 2.6 to 2.7 V dc reduces harmonic distortion by about 2 to 1. A separate oscillator power supply (pin 4) would permit the sound systems to be disabled while the AM section is being aligned.

The modulator circuit can be set to any channel from 2 thru 5 by setting the variable capacitor. The circuit also features video synchronous tip clamping, and audio biasing to reduce distortion further. The value of the resistor at pin 1 permits the intercarrier amplitude to be adjusted easily with the minimum of RF oscillator coupling to pin 1. With a 12 volt regulated power supply, there is less than +10 KHz shift of RF carrier frequency from 0 to 50 degrees C for any video input level.

Fig 6 shows an alternate for the sound oscillator tank circuit.

CONSTRUCTION

Fig 4 is the parts placement and Fig 5 is the parts list.

This board was designed to fit within an Aztek remodulators case. There is no 3 or 4 switch and the audio and video ports are reversed, by layout constraints from the Aztek, Radio Shack, units.

It is suggested that once the board is stuffed it be soldered into some type of RF tight box, or at least walled in.

Set VC, 5 - 35 pf variable cap, to channel wanted with a video signal only input and the core from L2 at very top, almost clear out.

Then apply audio and turn L2 core in until audio is clear.

FUTURE APPLICATIONS

Later on we will hook this modulator up to a PLL, set at 45.75 Mhz. Its output will then be fed to a NTSC SAW filter for Vestigual sideband suppression. This signal will then be applied to a double balanced mixer. The LO input will come from a PLL running between 50.5 to 107.5 Mhz. By using the primary or the second harmonic this will allow setting the output from channel 2 thru cable channel W, above 13. IE a cable quality remodulator.

The 45.75 Mhz output will also be fed to a LM3064, AGC detector generator, which will give us a very positive AFC, since the 45.75 is PLL and will hold 1 part per million over temp. This AFC should be very tight as it is tuned to best picture and is currently used in most TV sets in one form or another. But we'll do that later. Gives you something to look forward to.

The PLLs used will be the inexpensive 55107/26 types that were so common in the CB sets of late.

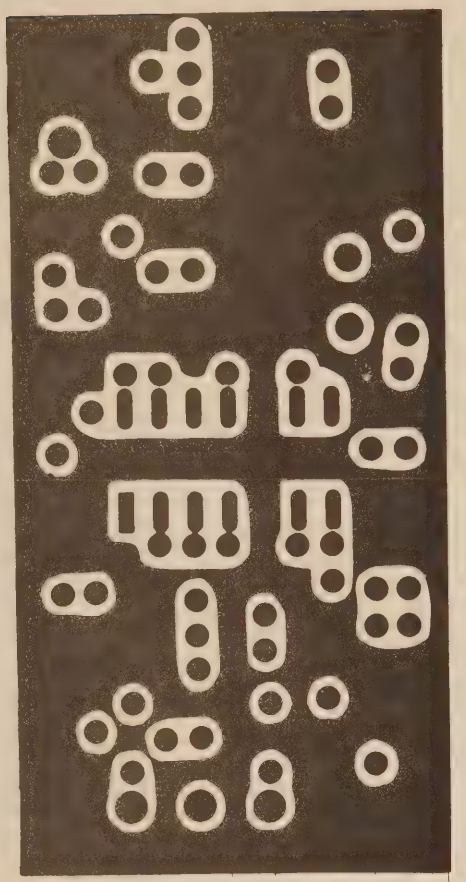


FIGURE 2 PC BOARD TOP

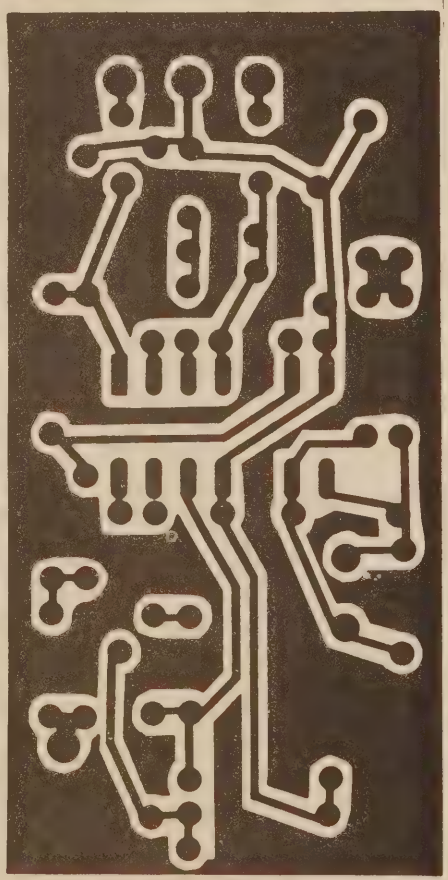


FIGURE 3 PC BOARD BOTTOM

FIGURE 5 PARTS LIST

PART	DESCRIPTION	QTY
C	22 UF electrolytic 15 volt	1
C	10 UF electrolytic 15 volt	1
C	1 UF electrolytic 15 volt	1
C	.01 UF ceramic bypass	4
C	.001 UF ceramic bypass	1
C	120 PF ceramic or mica	1
C	47 PF ceramic or mica	3
C	33 PF ceramic or mica	1
C	24 PF ceramic or mica	2
D	1N4454 or equiv. sw diode	1
IC	MC1374P Motorola IC	1
L	.1 UH min. rf choke	1
L	.33 UH min. rf choke	2
L	Tunable Min. IF Can	1
R	180 K 1/4 W 5% resistor	1
R	56 K 1/4 W 5% resistor	1
R	33 K 1/4 W 5% resistor	1
R	6.8 K 1/4 W 5% resistor	1
R	3.3 K 1/4 W 5% resistor	1
R	2.2 K 1/4 W 5% resistor	1
R	560 1/4 W 5% resistor	1
R	470 1/4 W 5% resistor	3
R	220 1/4 W 5% resistor	2
R	75 1/4 W 5% resistor	1
VC	5 - 35 PF Var. Cap.	1

ALTERNATE TO MIN IF can and 120 pf cap

C	100 PF ceramic or mica	1
VC	5 - 35 PF Var. Cap.	1
L	10 Uh Min rf choke	1

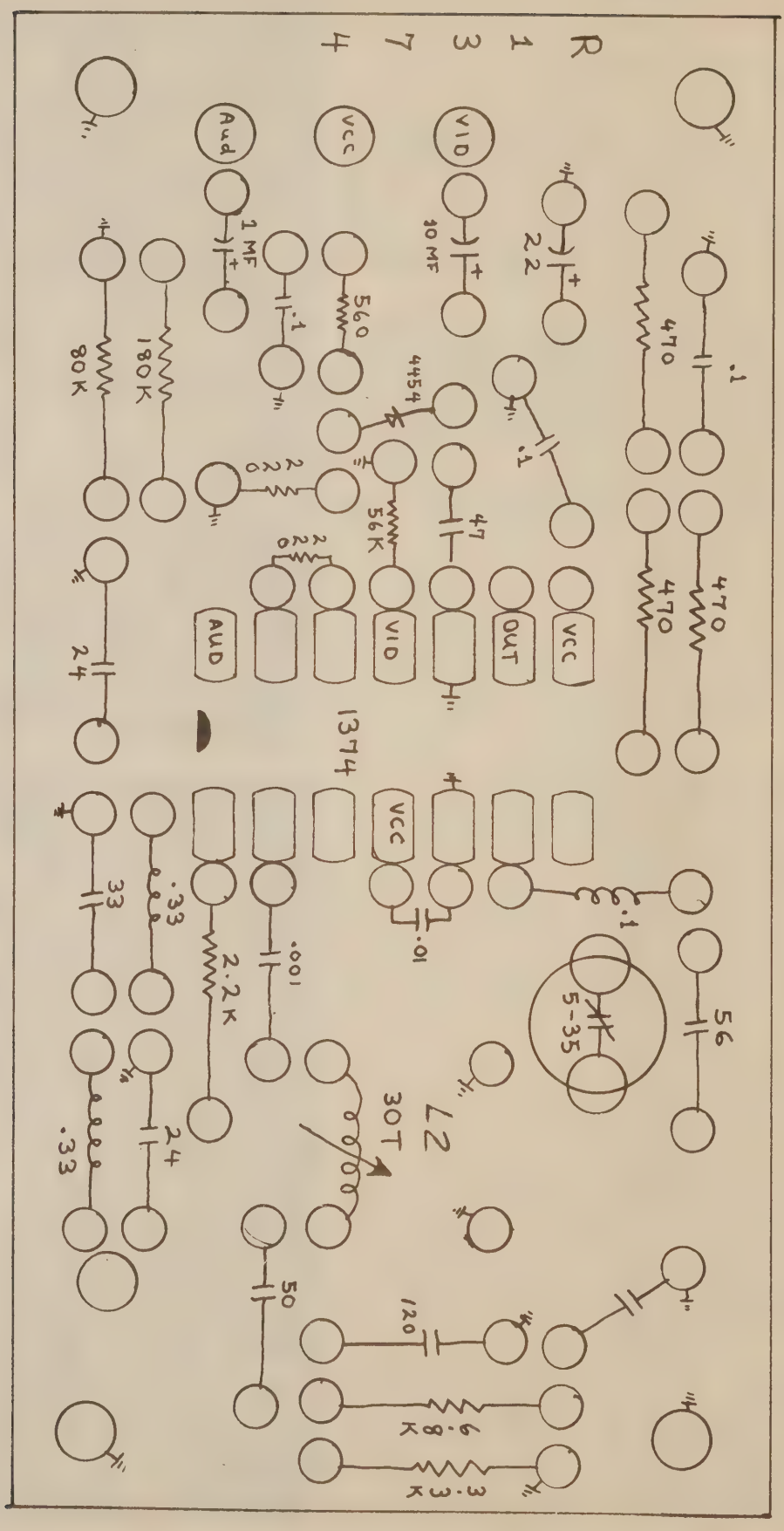


FIGURE 4 PARTS PLACEMENT TOP

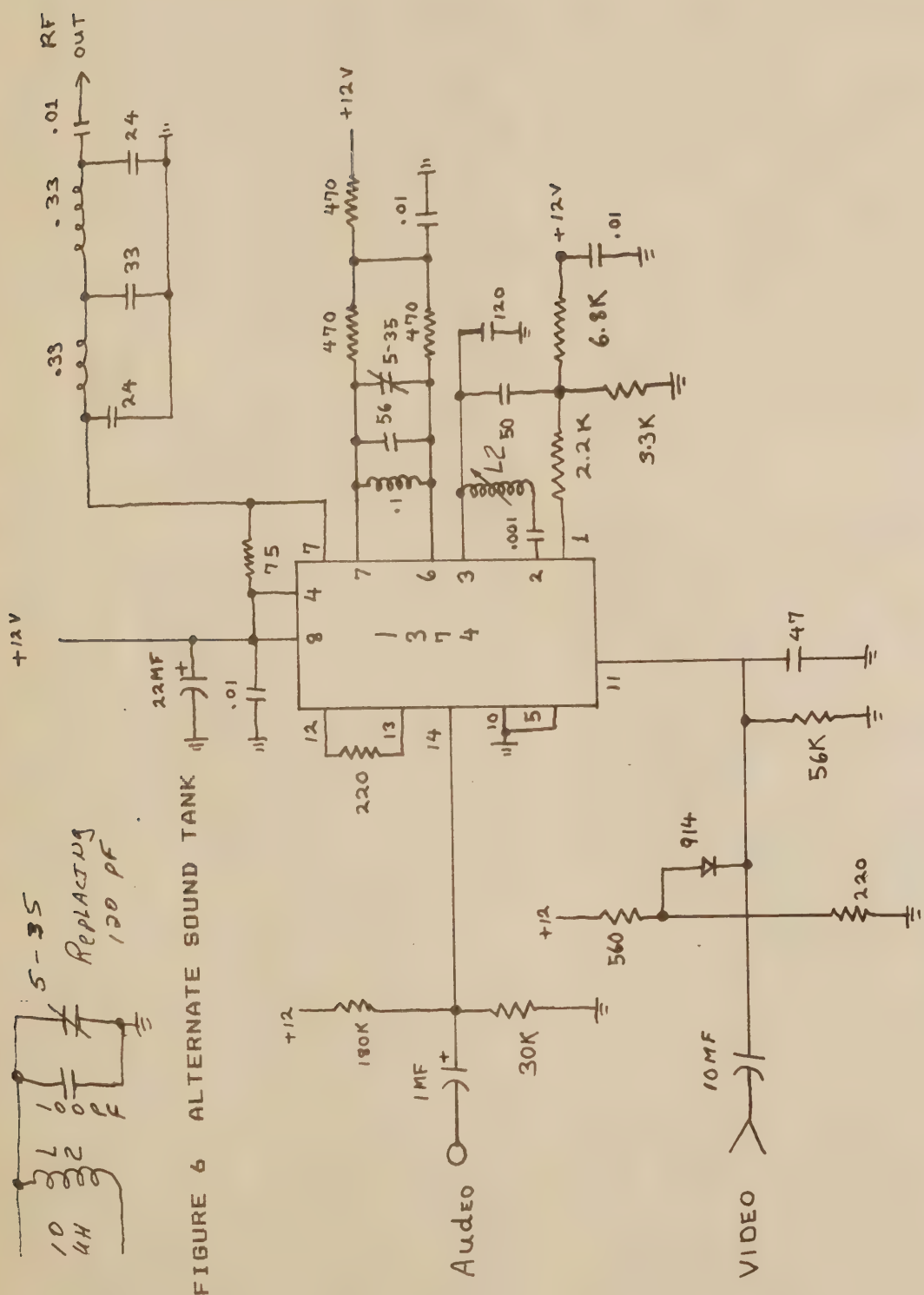


FIGURE 6 ALTERNATE SOUND TANK

FIGURE 1 SCHEMATIC DIAGRAM

SINGLE CONVERSION IMAGE REJECT DOWNCONVERTER

So far we have covered all the basic parts to build a truly modern TVRO receiver except for the conversion to some more usable frequency.

Just to recap.

In November we presented the variable gain inexpensive 70 Mhz IF strip and gain block, component 1.

In December the linear discriminator built around the MC1357 IC with all the needed perifery, CCIR de-emphasis, video gain, and de-dithering, component 2.

January/Febuary brought the variable audio and remodulation, component 3.

These three components make up a FAR better receiver, from the 70 Mhz IF, than most of the receivers on the market, NOW, and most certainly, with the exception of the two digital discriminator kits, ANY of the available kits.

If you don't agree with that statement then you've never built the other kits. These are easy to build and straight forward to set up, mostly done with a real picture.

NOW, we've got a primo set from 70 Mhz to the TV set.

How do we get from 4 billion to 70 million hertz, cycles for you old timers?

There are many ways to convert to 70 Mhz. Primary are, double conversion, single conversion and triple conversion.

Double conversion can be done in two ways, move the first oscillator and fix the second or move the second oscillator and fix the first. In the second method you would also need to move some type of filter prior to the oscillator or treat it like a low frequency image reject mix, very complex.

The first method is the normal technique used. It is used in the "Howard/Coleman" kits and all double conversion type receivers. Its advantage is no images. The disadvantages are cost, two hundred dollars worth of oscillators etc., set up time, cross over mixes that show up inband, unless you are very careful or lucky, and it requires specific, expensive, test equipment. It is a real pain to use, I used to spend Two hours on each receiver getting the two oscillators and the two 900 Mhz filters set for best gain and least crossover interferance.

So much for double conversion.

SINGLE CONVERSION.

Single conversion looks at first glance to be the worlds simplest way to get from A to B. I would like to have a dime for every person that I've talked to that was going to use the "Coleman" active mixer and do single conversion.

Here is a primary information gap. First this active mixer is far more trouble to make operate properly, DON'T BURN UP A GASFET IN IT, than it is worth. Next, as most engineering students can tell you, it is a single pole mixer, not balanced. So it outputs every signal presented to and ALL their harmonics and ALL their cross mixes and all the cross mixes harmonics. Get the picture. You are going to get so many signals out the output port that you won't even know about the other side image. These things look great when hooked up to signal generators, but real world is much different. This type mixer is only found in cheap AM receivers today, 455 Khz bandwidth. No quality equipment would or could put up with it. WHY SHOULD YOU.

Next, I get calls saying they are going to use one of the balanced type, stripline, mixers to convert down. While these are far better choices for mixers they will still provide outputs of the image frequency. This type of mixer is the stripline 3 db splitter or the rat race type.

Next to the "active" mixer the next worst, in my book is the double balanced broadband "diode quad" type. These broadband units work great if preceded by a band pass filter to limit their bandwidth. However, since none, Howard included, does, these will generate large amounts of out of band noise which in turn force the IF filters to work that much harder. Besides that they also pass the image without attenuation.

So what looks at first glance to be the nice simple answer falls on its face. Actually if you stop to think about the band as a whole the above answers are glaringly apparent. This band is 500 Mhz wide in one continuous swoop. Every 20 Mhz there is an 18 mHz wide channel which is attenuated, on the average, 40 db from the adjacent polarity signal, every other one being on one polarity the evens cross polarized. And the signal generally leaves the 50 db LNA at a level of - 90 db, which is REAL small. But that is the real world of what is available.

The answer was first used by the radar types back in 1945, or so says an old Army radio book of mine. Shift the unwanted signal and combine, mix, it out by presenting the unwanted signal 180 degrees out of phase to the image. In this way the image is 180 degrees out of phase and cancels the image while the wanted signal is presented 360 degrees out of phase and boosts the wanted signal. This can be accomplished using some interesting math gyrations. The process used by the radar people was anything but simple, remember this was still pretty much the age of tubes and fairly low frequency.

Barker first published the most recognizable version of this type of mixer in the early days of "Coop's" digest. I think this probably started most of use thinking along these lines. When I first saw this circuit I was using a block type of triple conversion. Needless to say the utter simplicity of this approach grabbed me in the proberbial place. I was already using the NEC 5121 hybrid amps, 27 db from 10 to 900mhz, so I wasn't thrilled by his use of MWA or Avantek packaged transistors. I did like what I saw up thru the Mini-Circuits 90 degree combiner. So I "recreated" the stripline and combiner but added my amplifier. I also used the Avantek VTO. Later I changed over to the Watkins-Johnson VTO because the Avantek had a tendency to "pull", shift frequency, if the stripline got its impedance pulled by an input mismatch. The WJ did not and its FM noise, which means little unless you are working narrow band, was less.

The Splitter in this stripline had a tendency to need to be tweeked in order for it to provide good "flat"

response. In production, tweeking each unit becomes cumbersome. This front end, and GHZ Engineering, got swallowed by and is still used today under the KLM name, as did the rest of Barkers receiver design. The receiver portion has been changed over the last several years but the front end, down converter, is still the same. And its still very reactive to mismatches between it and the LNA.

The constant tweeking of this splitter finally got to me, Product Development Engineers don't like spending production time on Tweeking. I then contacted an old friend of mine whose specialty was microwave, at a company that builds satellites. I asked him if I couldn't just use one of the "standard" 3 db splitters in its place. After all it also rolled the 90 degrees per port. It was also less prone to mismatch changes in its geometry, being built of 50 ohm strips. His answer was "of course". So I replaced that troublesome chunk with the "standard" splitter. I still use it that way today. It worked extremely well and is the simplest.

One note here. This 3 db splitter that I call standard is called that because if you buy a stripline design kit from places like 3M, and others, this is one of the templates, with scaling info, that comes in the kit. If your into playing with stripline contact 3M they have an excellent Design Kit available and excellent backup info as well.

This made the single converter simple and very impressive. It still had two problems.

First the Mini-Circuits combiners were not predictable. One front end would come out with 22 db of image rejection. The next would have 8 db or 13 db or whatever. The kind of things that made you chuck about 2 out of ten of these expensive circuits. Later I'll explain how I solved this problem. For now I'll only mention that except for Automation Techniques, who defined and corrected this problem also, All of the "IMAGELESS" single conversion receivers on the market, including AVCOM, are still using this hybrid.

The other problem was the VTO. They were downright hard to get. To give you some idea of how hard. At the Houston show, November, I was told by Watkins-Johnson that if I would give them a check, up front, for 100 oscillators they would ship immediatly from "shelf" stock. I had been limping along with 20 to 30 oscillators per month, all I could get, from Avantek. SO I jumped on it and gave them their money. Three weeks later I got 15. I finally received the last of them in March, four months later. Having spent the money I was strung out on these 50 parts and turning down or simply getting behind orders.

This is another one of those things you don't do to Design Engineers.

Sometime in here someone had dropped by with a copy of Butch Simpsons' "microstrip" manual. In it Butch detailed an oscillator, or better named a multivibrator, that worked at some microwave frequency. Sorry Butch I can't for the life of me remember what it was supposed to run at.

I was desperate for oscillators, I was turning away orders. So I called my friend and asked if he had any simple answers for oscillators. He sent me a half dozen circuits. All but one required a microwave Voltage Variable Capacitor diode, price 25 dollars availability 5 weeks. One, however, rang the bell in my memory. It was a two transistor multivibrator. Bingo. I spent several days searching thru the piles of papers and schematics. If you've ever seen a design engineers office then you'll understand if not it is a lot like going thru a pile of the last ten years worth of newspapers looking for one article. We may not be real neat but we never "lose" anything either, it may take months to find it but its always there. Anyway after much searching I found the multivibrator schematic I had rather hurridly scratched out from the Simpson manual.

I had, in my haste to "get" the schematic, drawn it out in skeleton form, you know "I'll put the values in later" type. The two were virtually identical. I later found out this was also one of the microwave types "standard" circuits.

This oscillator also rang a bell as it was just a "scaled" current controlled multivibrator. Which we used a lot before the advent of IC VCO multivibrator units. It took a while to get over the shock that here was a circuit we had used in design work in the early sixtys back again.

My initial reaction was that nothing that simple could be the answer. It just seemed to simple. But I was desperate. All I had for transistors that had the needed frequency cutoff, Ft, was some NE578s. I also had no idea how big to make the "inductive component", or coil. But relying on a Design Engineers best help, luck, I built one on one of my regular downconverter boards. I figured that the coil would want the least possible impedance, or skin effect resistance, so I pulled some of the silver wire, used as the center conductor, from some RG142 microwave, semi hardline, coax for the "coil". I wrapped it around one of my tuning tools, I figured it had to be fairly small. Then I built it, kinda suspended in air, above the ground plane. My signal generator was cold so I hooked it up to the 213 coming in from my LNA. Hooked up the Spectrum Analyzer to the output and fired it up.

Lady Luck was sitting on my shoulder. The Analyzer popped up signal at 70 Mhz. I sat there dumfounded for a couple minutes afraid to touch anything. Then I got the guts and hooked it to a receiver laying on the bench. Bingo. It produced picture. Wrong polarity but I didn't care.

Anyone who has first fired up a new circuit will know how you feel, kinda mix of elation and disbelief. Don't let anyone kid you it always feels that way and it always takes a little time before you "logically" decide to tinker with it and see what happens. I spent the next six hours "playing" with it. At one time I even almost paniced when I pooffed a transistor. I think every person in the whole shop must have been shown these newly "discovered" pictures and what was doing it. I think I spent most of the night watching and protecting my "discovery".

Next day I had George rework the artwork and two days later we built the first 10 units with this new oscillator. They all worked gloriously.

I was still frustrated with the Mini-Circuits combiner. And since we were about to scrap the "old", six months, board anyway. I decided to find a way around this problem also. You know how the saying goes "when your hot your hot" and I wasn't going to pass it up.

I knew how to combine signals with resistive components, so I knew I could get the two sides back to one. I had also from experience known how to replace the 5121 with 3904s. I had a breadboard set up and running to do that, that was to have been my next change. I also knew that the resistive combiner was going to cost me gain. That meant I was going to have to add gain in front of the combiner. Experience with simple grounded emitter, the simplest and most broadband type, had been gained from years of interfacing computers to linear circuits. So I knew I was going to have to limit my input to these amps with a pass band filter of some kind.

My computer told me one of those interesting things about filters. The pass band of a .15 uh choke and a 33 pf cap was the same as a .33 uh and a 15 pf cap around 70 Mhz. The impedance was more suited using the .33 uh choke and the 15 pf cap in series. so you'll find that in the two base circuits coming from the mixers.

Now only one problem was left to solve. How to vary the time delay between the two sides to provide the best rejection off the image. Time domain delays are caused by capacitors and inductors. Vary the inductance and the delay and phase angles change. Same is true of caps. Variable inductors are bulky so I decided to vary the capacitor. I originally tried a 1 to 10 pf variation assuming the differences would be very small. However there are also delays in all the components and the stripline before these elements. I ended up with 5 to 30 pf for production. With this you can get 25 db image rejection or more.

I was also using 14 dollar per set mixer diodes. I wasn't happy about their cost. Solid state physics will tell you that if you forward bias a diodes junction it will switch with a lot less vailance penetration better known as noise. NEC had provided me with some low cost, less than a dollar, matched diodes to replace the HP5082-2800 diodes I was using in the old discriminator. I plugged these in and fed them some current. It worked.

George then did a wholesale relayout of the board and we checked it out just to be sure.

I've been using this board for the last year and one half. Yup it checked out.

SO MUCH FOR HISTORY.

HOW IT WORKS.

You probably got most of this from the evolvement preceding. So I'll just recap here.

The 3.7 to 4.2 Ghz satellite signal coming from the LNA is split into two sides out of phase by 90 degrees. These are then presented to a pair of balanced mixers which are commonly feed by the oscillator. The 70 Mhz resultant signal is passed by the diode pairs, D1 - D2 and D3 - D4, to a stub with a 4 Ghz open stub to attenuate the 4 Ghz residual energy. These diode pairs are forward biased to enhance noise performance by a RF blocking inductor and current generating resistor shunted by RF bypass capacitors.

The oscillator can be either a MIC type or the two transistor multivibrator type as presented. This oscillator can be set for either high side, images in lower transponders, or low side, images in high transponders, injection. I prefer the high side mix as this leaves the movie services virtually without images. However if imbalances, non lineararitys, occur this has a tendency to weaken the input at PTL, transponder 2. So if your primary interest is the PTL channel then use the lower side injection. For some unexplained reason this only seems to effect the one transponder.

The two 70 Mhz signals are then coupled to the bases of two identical grounded emitter amplifiers based on NPN transistors with Ft of 300 Mhz min. Theoretically if lower noise parts were used here the signal would be better. In real life very little change has been noted by changing these parts. The coupling is performed across a series inductor and capacitor which form a pass band filter. These two outputs are sent to a resistive combiner via a blocking cap and inductor, on one side, and a variable capacitor, on the other side. The variable capacitor functions as a variable delay and is used to set the best image rejection.

The combined signal, with the image mixed out is then passed to the base of another amp which is the start of the drive gain. This amp provides 15 db typical gain. Its output is passed thru a 70 Mhz high pass filter to remove any low frequency noise and adjacent channel signal that may have been applied by the amp. This signal is then amplified another 15 db by the final amp and feed to the 75 ohm coax via another series filter.

Control voltages are brought on board thru power type silicon diodes. There are two reasons for these diodes. The apparent reason is to keep the user from reversing the control voltage, -1 to -14 volts, with the power, +12 volts, or protection. The other reason is not that apparent. It is to provide some thermal tracking to the oscillator. The diode junction will change its resistance slightly at nearly the same rate as the oscillator transistors. This doesn't mean exactly but some is better than none.

CONSTRUCTION.

Figure 1 is the schematic diagram of the unit. Fig 2 is the top and fig 3 is the bottom parts placement. Fig 5 is top and fig 6 is bottom of pc board. The board material is Duroid .031 1 oz. copper both sides. I don't suggest you etch this board yourself. The cost of buying one can save you money in the long run.

Put all of the parts except the oscillator transistors, two 1 k, 330 and loop on the board and solder. Be careful mounting the diodes and chip caps on the bottom. Also be sure to check that the variable cap is soldered and connected properly on the bottom to its two traces. Check from each lead on the cap back to the transistor and from the other side to the 75 ohm resistor with a VOM to insure.

At this point you have a choice. I suggest you now make the enclosure, see HOW TO BUILD ENCLOSURE, and mount the board. You don't have to but it is easier to work on if its in the shell.

Refer to fig 4, oscillator detail. On top of the board, pick up the open end of the 100 ohm resistor, located at E 6, take a .001 or .01 ceramic capacitor, cut both leads to about 1/4 inch length. Solder one leg to ground plane so it is standing with other lead up and touches 100 ohm resistor lead. Solder these two together.

Bend emitter lead one one transistor to form a L shape down and bend base down also. Flow some solder on small pads at E 5 and F 5. Put base lead thru hole and set the emitter lead on the small pad. Solder emiter to small pad. Carefully solder base lead, top and bottom so that the transistor is suspended above ground plane on pc board. If using a transistor with four leads bend unused emitter lead up and over transistor and out of the way. Do the same thing to the other transistor.

Cut one lead of two 1 K resistors to 1/4 inch. Solder this end of one to one of the small pads with the emitter. Do same for other side. Put the open side of each to the point where the 100 ohm and the capacitor are connected, E 6, and solder. Trim excess.

Cut one lead of a 330 ohm resistor to 1/2 inch. Put this lead thru board at E 3 and solder to bottom side.

Put a small square of tape, masking etc, on pc board to cover central area, about E F 4 to E F 5, to insure that oscillator coil, L, or collectors won't be able to connect by accident to ground plane.

Coil, L, is wound around a 1/4 inch bolt for NE578 transistors or a 3/8 inch bolt for the 021 type transistors. Wind using silver coated wire if you have some. The wire is the size of the center conductor in RG 59 cable and that might work. I use the center conductor wire from RG 142 microwave coax. In any case wind about 4 turns. Then unscrew the bolt. Go half way around the first turn and cut. Throw the cutoff piece away. Go on around the coil 7/8 of the way, 7/8 of the full loop, and cut. That is L.

Holding the loop solder the collectors of each oscillator transistor to the two open ends of the loop. Hold the loop about 1/4 inch above the board and bend 330 resistor to touch. Cut off excess of 330 resistor. Lift loop slightly to allow resistor to be positioned under it. set loop on resistor lead and solder. Be carefull not to use to much heat when soldering as the loop will heat up and the collector leads will let loose.

Now using some cut off resistor lead push one end thru the pc board at G 4 and solder to bottom. Bend so it is bisects over the loop, L, but doesn't touch. Cut off any excess that clears the other side of the loop by more than 1/4 inch.

The oscillator is now built.

SET UP.

If you don't have - 15 volts available see schematic at fig 10 and use this to steal the needed negative voltage.

Fig 11 shows the schematic for a very stable and simple negative voltage tuning circuit. Build it and check to insure its operation. Set for - 2 volts.

Check for any solder bridges.

Apply + 12 volts to B + input diode and - 2 volts to Tuning diode. Check that each transistor has about 6 volts on the collector and about .6 volts on the base. Next check that the diodes have about .4 volts at E 8 and E 1 and about .2 volts at their junctions, E 7 and E 2. The stripline should be about .002 volts. Reference fig 3.

If voltages check out hook up signal source to input. I say this rather glibly. I don't like using a generator. I hook up to my LNA, via the coax. This has the advantage of giving me a truly broadband signal. However if you don't have a live signal set your generator to 4.2 Ghz.

At this time I hook up the output to my 70 Mhz input to the receiver. swing the tuning voltage thru the range - 1 to - 15 volts. Keep an eye on the TV set or, if your monitoring the video with a scope, the scope for video. If it pops up and is inverted switch to that polarity.

Generally you will pop up a recognizable picture in this pass. If not rest the tuning voltage to - 2 volts and check the two oscillator transistors collectors. You should find around 10 volts. Check the emitters they will be around + .5 volts, thats right plus. Remember the current controls this multivibrator not really the voltage. If you find the collectors or emitters are not close, in voltage, to each other turn it off and check your solder connections. Then recheck.

Now look at the picture you should be close to the last, 23 or 24 transponder. If not turn the control voltage toward - 1 volt until you either run out of pictures or voltage. If you run out of voltage before the last transponder push the coil toward the ground plane in very small increments, with a plastic pusher like a denuded Q tip, until you have the last transponder at about - 1 volts. If you run out of pictures and the voltage is still above - 1 volts then use the above tool to push the coil away from the ground plane. Move the pickup so you don't short out to it. Don't place to much emphasis on its placement at this time it is really less critical than you think.

The object of this movement is to get transponder 23 or 24 to produce the best picture at - 1 volts. Sometimes this requires reversing the polarity again. You will find once you start to get pictures that you will be able to get pictures from either polarity.

When you have the right polarity you will have strong pictures without the opposite video at the high end and you will have reversals between channels on the lower, 1 to 15, transponders. That is the normal set up.

In any case pick the best pictures as you dial across the band from - 1 volt to - 12 volts, typical.

If your feeding a signal generator in set for best RF out at 70 Mhz with the 4.2 Ghz in. Then as soon as possible get some live signal and set as above. It is not possible to set the reject circuit without live signal, without some very sophisticated test equipment.

Sweep across the band. If it seems to be low at the

	DISCRIPTION	ASSEMBLED/ TESTED	COMPLETE KIT	PC BOARD
1.	RECEIVER & FRONT END	$550	$400	$100
	This is John Rohners BASIC satellite receiver in kit form. A single conversion split type system. Two PC boards. 2 AND 3 BELOW. Does not include cases, hardware, or power transformer. INSURANCE - $40.			
2.	RECEIVER ONLY	$350	$250	$50
	The Receiver board from 1. For use with 70 mhz input. Demod is DIGITAL discriminator. Max. Video out - 2 V, Audio - 1 W. Variable audio selection (5 to 8 Mhz), AFC, AGC, and most of power supply. INSURANCE - $30.			
3.	FRONT END (DOWNCONVERTER)	$300	$200	$50
	This is John Rohners single conversion image reject downconverter from 1 and as presented in the March issue. Replaces the troublesome double conversion to 70 Mhz. Can be remote mounted. INSURANCE - $30.			
4.	LNA (4 GASFET)			$5
	The 4 GASFET LNA circuit by John Rohner. NOT FOR BEGINNERS. For NEC 218 type GASFETs.			
5.	LNA/DOWNCONVERTER (3 GASFET)			$5
	The 3 GASFET LNA and Hybrid mixer for use in building a double or Block converting system. NOT FOR BEGINNERS.			
6.	70 Mhz AMP/FILTER	$65	$50	$10
	A replacement 70 mhz IF strip and variable amplifier by John Rohner. From Nov. 81 TVRO Digest. INSURANCE - $5.			
7.	DIGITAL DISCRIMINATOR	$150	$75	$20
	A digital type discriminator to use as a high quality replacement for the PLL. Used in 1 & 2 above. INSURANCE $15.			
8.	AUDIO DEMOD/REMODULATOR	$65	$50	$10
	Variable (5 - 8) converts to 4.5 mhz, with video remodulated for TV. From Jan. 82 TVRO DIGEST. INSURANCE - $5.			
9.	AFC/SIGNAL METERING	$50	$35	$10
	AFC control, signal strength and band position meter drives. dual metering, agc drive adaptable.			
10.	MTV TYPE STEREO DECODER	$75	$50	$10
	Decoder For MTV, IMC type stereo systems. Max. output 2.5 w audio. From Dec. 81 TVRO DIGEST. INSURANCE - $10.			
11.	1357 Discriminator Strip	$110	$65	$10
	Complete Discriminator strip using the MC1357 Audio Demod. circuit. From Dec. 81 TVRO DIGEST. INSURANCE - $15.			
12.	DIGITAL Channel Selector.	$100	$75	$10
	Use two thumbwheel, or any othe BCD, inputs to set your receiver on the desired transponder. From Jan. 82 TVRO DIGEST.			
13.	PLL Video Demodulator	$75	$50	$10
	This is a direct replacement for the Howard-Coleman unit, with the design errors fixed, at less than 1/4 the size. Two versions available standard and divided by two, $10 extra. INSURANCE - $15.			
14.	SAA Satellite Audio	$40	$25	$5
	This is the audio module Mr. Cooper used in his Molnia receiver and speaks so highly of in his "Operations Manual". Similar to the TV sound modules. Can be set to any frequency. INSURANCE - $5.			
15.	1374 Remodulator	$40	$25	$5
	This is the high quality remodulator using the MC1374 IC from the March TVRO Digest. INSURANCE - $5.			
16.	DOUBLE CONVERT FIRST MIXER		$10	$5
	This is a replacement for the expensive broadband mixer. requires a 8240 type OSC.			

Gerard L. Mosher
Publisher

Satellite TVRO Technology, Ltd.
P. O. Box 318
West Liberty, Iowa 52776
(319) 627-4983

Effective: MARCH 8, 1981

Dear Satellite TVRO Manufacturer.

This letter is being sent to you to provide you with information and to ask your help. We would also like to introduce you to our magazine. We think, and hope you would agree, it is the finest technical journal available. Our readers seem to feel it is. Our ad rates are currently low to provide the best access to all factions within this new and exploding industry.

All ads will be run on faceing pages, 2, 4 etc., as shown. We will limit advertising to these face pages, so ads can never exceed 51% of the magazine. We feel this will serve your interests best, as no one can simply pull out the section and throw your informative ad away.

Our rates:

BACK COVER	$1200	INSIDE FRONT COVER	$1000
INSIDE BACK COVER	$800	FULL PAGE	$500
1/2 PAGE	$300	1/4 PAGE	$200

15 % discount on contracts of six months or longer. Back and inside covers on a first come first served basis. All ads to be camera ready black and white. Payment for ad must accompany order. Must be at publisher before the 15 th of the month preceeding issue you want in. In case all ad space is sold prior to your order you will be given option of return of money or space in next issue.

We can produce your ad from your sketch and pictures for $65. In case we must produce your ad be sure to allow enough time for production and YOUR approval before publication. We will not publish any ad that has not been seen and aproved by the advertiser.

The Electronics Industries Association, EIA, has invited all TVRO manufacturers to join them in a conference of the Satellite Communications Section at the Shoreham in Washington, DC. March 30, 1982 at 9 am. This is our chance to join a REAL trade association. Be there if you are manufacturing for one of the topics will be standards. The EIA sets THE standard for all others to follow. Here is your opportunity to get legit don't lose it.

Lastly, We would like to produce two shows per year. To determine where the next show will be held, we would poll the exhibitors of the current show. We feel this would provide shows where needed around the country. These shows will cost the exhibitor $200 for the booth. The customer/enthusiast would be charged $5. We think this would get more prospective people out.

We are starting to work on the first show. We would appreciate your help. Please take the time to consider and jot down three dates and places you think a show should be held. Those three dates and places most asked for will then be sent to those participating to determine the RIGHT place.

Looking forward to serving you.

Sincerely

Georgia L. Rohner
Publisher

P.S. We WELCOME and PAY for articles published in the magazine.
Also please send a catalog for our files. Thank You.

17. BULK CONVERT MIXER/AMP $20 $5
This is a mixer as above with the MC5121 added for gain and drive. Requires a 8240 type oscillator.

18. FIRST IF FILTER/AMP/OSC/CONV $40 $25 $5
This is a replacement for the "HOWARD" First IF board with its own oscilllator etc. INSURANCE - $5.

19. DC POWER BLOCK $10 $6 $5
This is an unpackaged DC power block using the stripline to send the DC thru the cable.

20. TWO GASFET LNA $5
This is the two stage NE218 GASFET amp John Rohner Did in 1979. More stable than the Gillespie brd.

21. 10 foot parabolic dish $800
This is the high quality 10 foot fiberglass dish with polar mount. Four peices. You pay freight.

22. 13 foot parabolic dish $1300
This is the high quality 13 foot fiberglass dish with polar mount. Four peices. You pay freight.

23. 120 degree LNA $515
This is a high quality 120 degree LNA. Either MA or California Amplifier is available. With Block.

24. TRI STAR GYROTOR $175
This is the electronic rotor that everyone is so pleased with. Comes with its own built in FRESNEL FEED HORN. SPECIFY TYPE OF ANTENNA, Spherical or parabolic. If parabolic specify FD ratio.

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This is the FRESNEL FEED HORN. SPECIFY TYPE OF ANTENNA, Spherical or parabolic. Parabolic spec. FD ratio.

P A R T S

IC1	10216	line receiver	$1.50
IC2	10131	Dual Flip Flop	$1.50
IC3	10102	Quad Gate	$1.00
IC4	1808	Demodulator/amp	$1.00
IC4	373	IF Strip	$1.00
IC5	733/592	Video amp	$.75
Q1	NE021	Microwave Transistor	$1.00

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bottom put a .01 cap between the open end of the pickup and ground. This and moving the pickup closer or further from the coil should give you about the same pictures for all the transponders across the band. These are the easy fixes. If you don't get relatively flat response after these you may have to either live with it or mess around with the stripline.

Once you have the oscillator set put the lid on that side and recheck that you are still covering the high end around - 1 volts.

With the lid over the oscillator turn the unit over, oscillator side down, and place back in front of you. Form the wooden Q tip, or use a plastic tuning tool, to a small straight blade screwdriver form to fit the slot in the variable cap.

Select the MTV transponder, or Showtime. As you tune back and forth across threshold you will see what looks like a picture in the background. Tune the variable cap for the minimum, or none, of this interference. IE best, cleanest picture. Now retune to PTL, or Nickel., and touch it up again. If your images are at the other end of the band then use equivalently spaced transponders. Sometimes you will end up compromising for the best overall pictures. Admitted this isn't the most scientific way to do this but the results will be about the same. If you do have a spectrum analyzer the you can set the images from what you see as they cross over. Don't be confused by the fold back, inverted, signals. Your trying to tune out the opposite side transponders which will show up just as you come on frequency from the other side. Set by rolling the tuning while tuning the variable cap. Typical rejection is from - 18 to - 28 db depending on components and stripline matching.

Put the lid on this side and recheck.

Seal the unit against the elements with silicon seal or similar non hardening sealer.

You have now only to take it back out to the antenna and set the system wiring etc. up to use it.

MAKING THE CASE.

Figure 8 shows the dimensions of the case wrap around. Figure 9 shows the lids, two needed.

I use a solderable metal called Mu metal. But at four dollars per square foot its kinda expensive for most budgets. So find some .032 or thereabouts copper or brass plate.

Cut to dimensions shown and bend at the bend lines. Drill to take the N type connector and F type connector as marked. Drill two more holes to take whatever your going to use for pass thrus.

The two pass thrus are nothing special. Use whatever you can find handy or improvise. They simply get the voltages thru the metal without shorting.

Now you find out why I recommend brass or copper. Solder the two open ends together to form the square chamber.

After you've stuffed the pc board set it in. It should fit closely to the two long sides and tight over the N connector. Solder the pc board to several spots top and bottom between the ground plane and the two long sides and the N connector side. There will be some slack, about 1/2 inch, at the F connector side.

Wire up the capacitor to the N and F connectors and the two diodes.

When completed this will be an efficient, soldered container. IT will not be pretty. But remember when it goes at the antenna you'll cover it with some polyfoam insulation, for thermal protection, anyway and you can make that look pretty.

INSTALLATION

I recommend putting 10 to 15 feet of RG 213 or RG 8 coaxial cable between the LNA and the down converter. This is done for two reasons. First to keep the oscillator out of the LNAs field of view, YES it will leak some RF energy. But more importantly to give the stripline a transformer. The stripline is set up for a 50 ohm impedance. If the LNA had an output VSWR of 1 : 1 then it is also 50 ohms. That never happens. They run typically 1.5 to 1.7 : 1 or around 60 to 70 ohms. The mismatch will detune the stripline and cancel all your hard work by making images.

Next I recommend you go to the local lumber yard and get some polyfoam insulation board and glue. Build a box completly encasing the front end. This will give some thermal protection and will further waterproof the system.

Attach to the back of the dish or in the tripod of the spherical antenna securely.

I use a four conductor type rotor cable to run my voltages and ground out to the system. I like this, or telephone wire, because each of the wires is a different color. Good quality RG 59 type cable should be used. Runs as long as 200 feet, or longer if you've got the gain in the receiver, can be run without additional amplification. For longer runs use a TV amp every 200 feet.

Hook it to the receiver and kick back and enjoy.

Good Luck

Jim

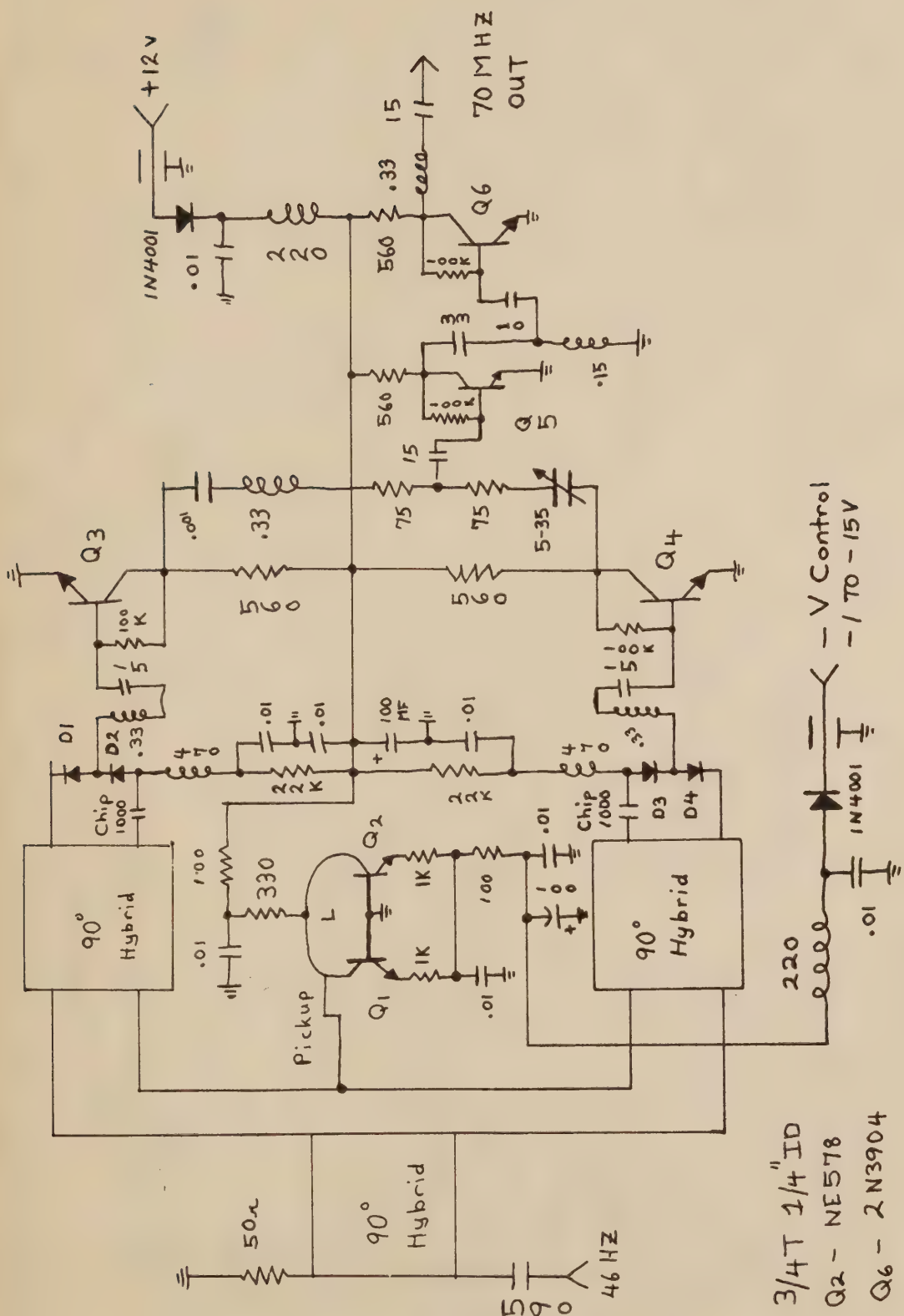


FIGURE 1 SCHEMATIC DIAGRAM

L - 3/4T 1/4" ID
Q1 - Q2 - NE578
Q3 - Q6 - 2N3904
D_1 - D_4 - NEC MIXER DIODES

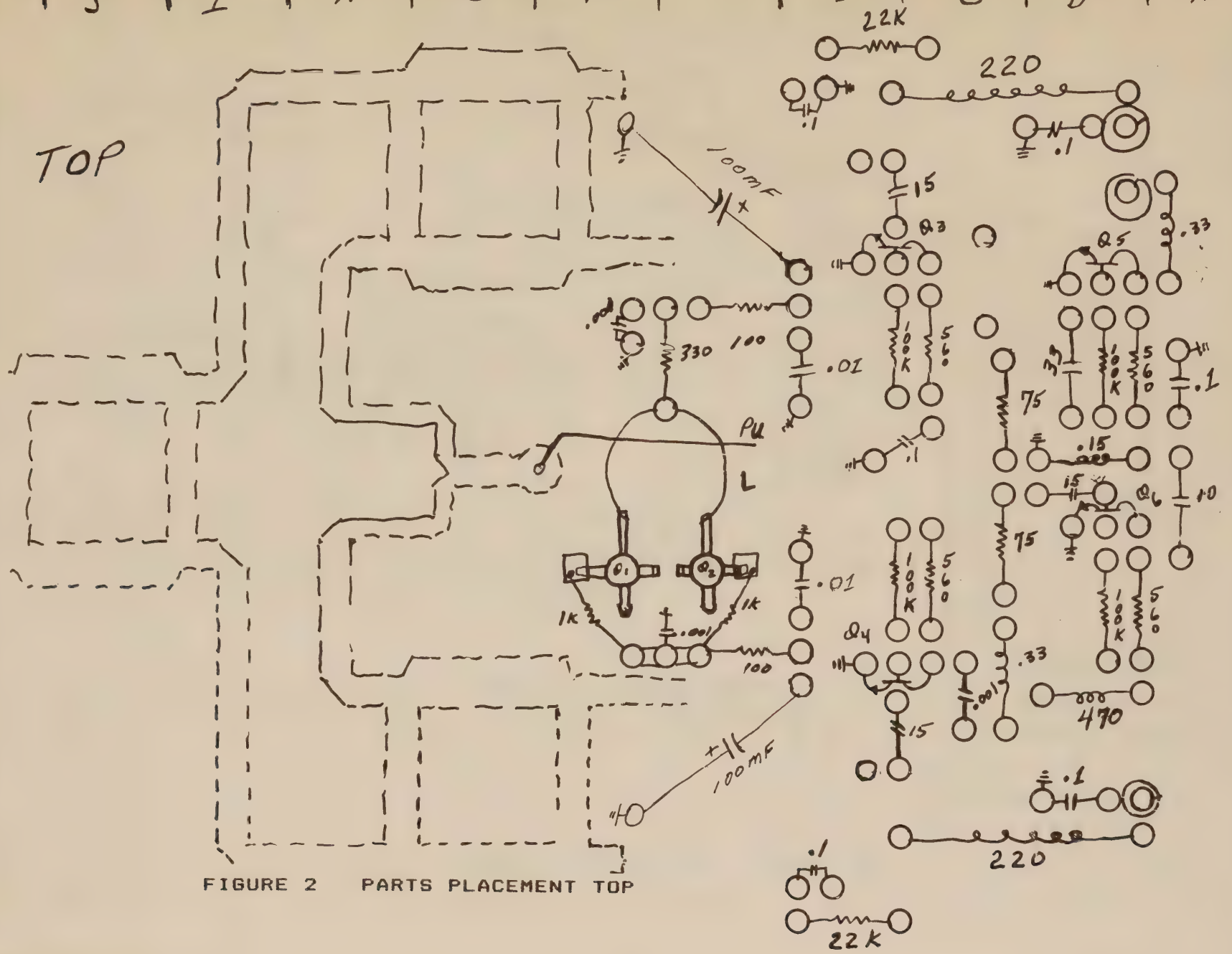


FIGURE 2 PARTS PLACEMENT TOP

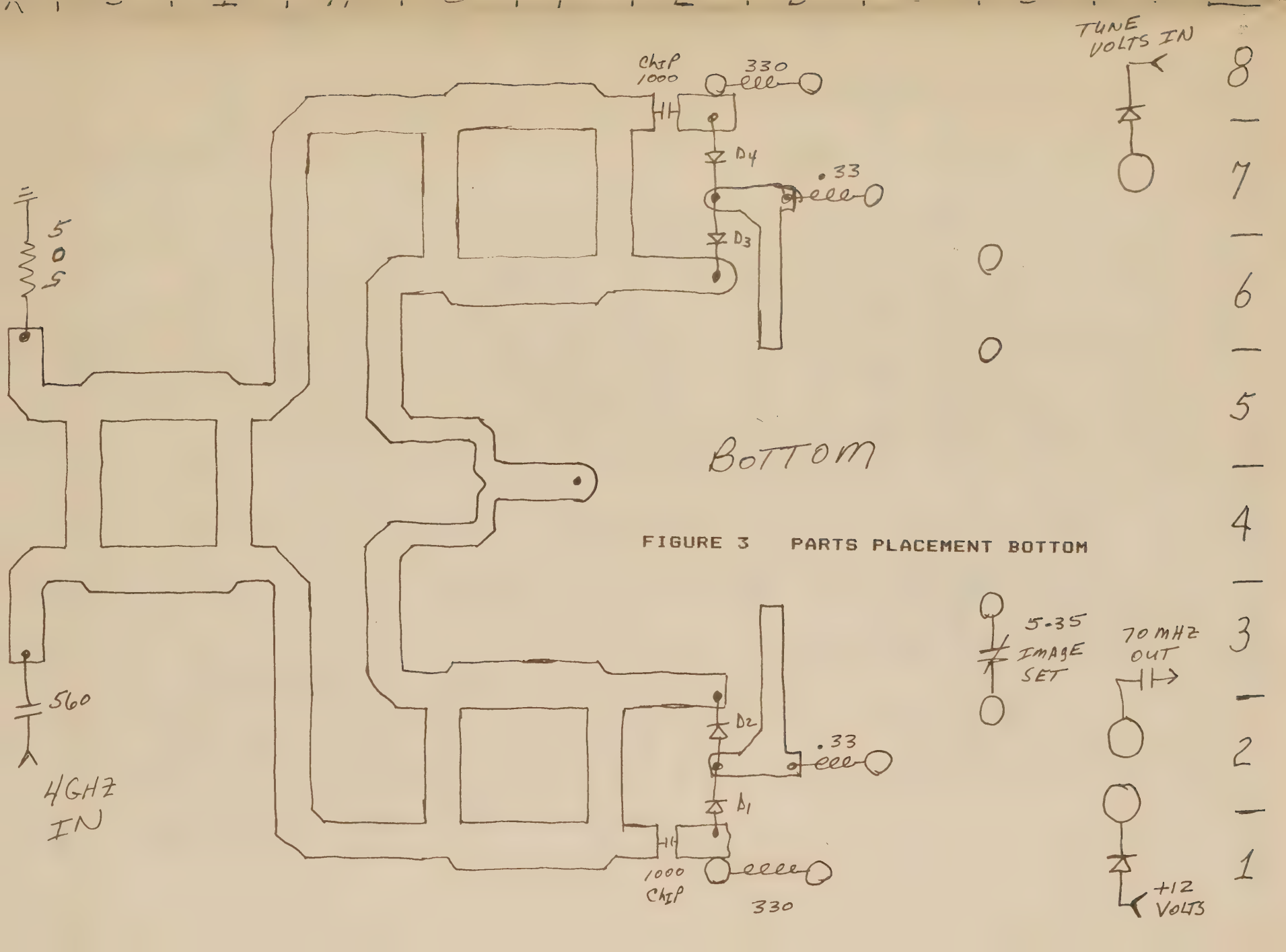


FIGURE 3 PARTS PLACEMENT BOTTOM

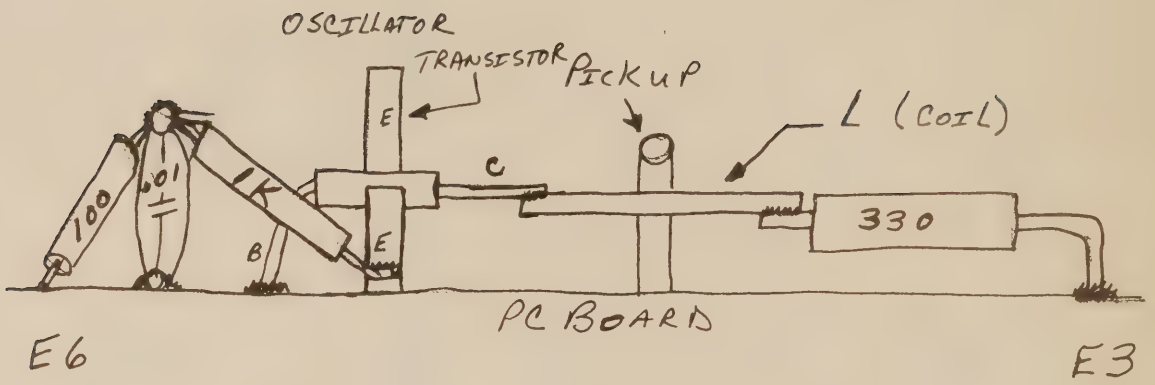


FIGURE 4 OSC. DETAIL

PART	DESCRIPTION	QTY
C	100 uf electrolytic 15 volt	2
C	.01 uf ceramic bypass	9
C	.001 uf ceramic bypass	3
C	680 pf ceramic	1
C	33 pf ceramic or mica	1
C	15 pf ceramic or mica	4
C	10 pf ceramic or mica	1
C	1000 pf chip capacitor	2
C	pass thru for B+ and TUNE	2
D	1N4001 or equiv.	2
D	1N5711 or 5082-2800 EQUIV.	4
L	470 uh min rf bypass	5
L	.33 uh min choke	4
L	.15 uh min choke	1
Q	NE578 or equiv. transistor	2
Q	2N3904 or equiv. transtr.	4
R	100k 1/4 watt 5 % resistor	4
R	22k 1/4 watt 5 % resistor	2
R	1k 1/4 watt 5 % resistor	2
R	560 1/4 watt 5 % resistor	4
R	330 1/4 watt 5 % resistor	1
R	100 1/4 watt 5 % resistor	2
R	75 1/4 watt 5 % resistor	2
R	50 1/4 watt 5 % resistor	1
VC	5 - 35 pf variable cap	1
CONN	N type panel mount	1
CONN	F type panel mount	1

For "STEALER"		
D	1N4001 or equiv.	2
C	100 uf or larger cap	2
For "TUNING"		
IC	LM337 negative var. reg.	1
C	1000 uf elec. 15 volt	1
C	.1 uf ceramic bypass	1
R	270 1/4 W 5 % resistor	1
VR	5 K 10 turn panel pot	1

FIGURE 7 PARTS LIST

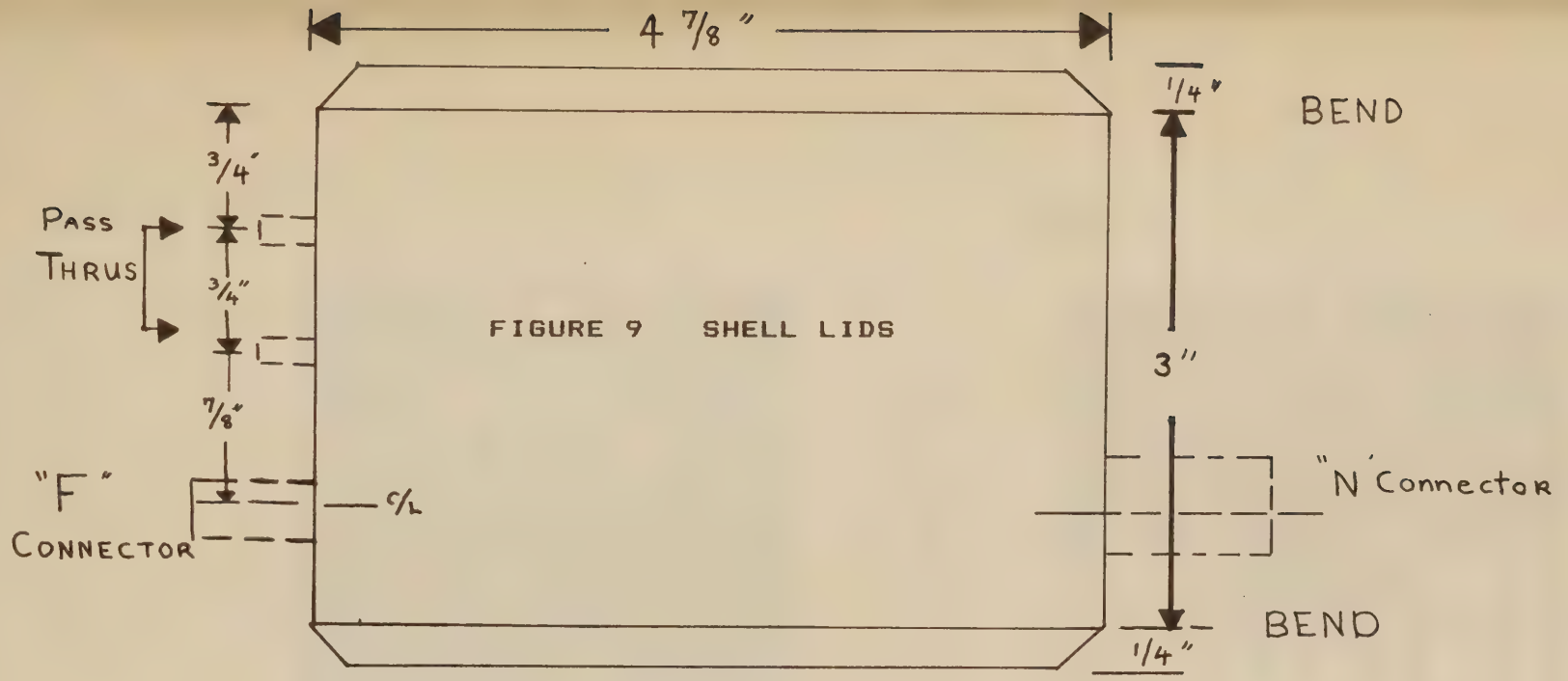
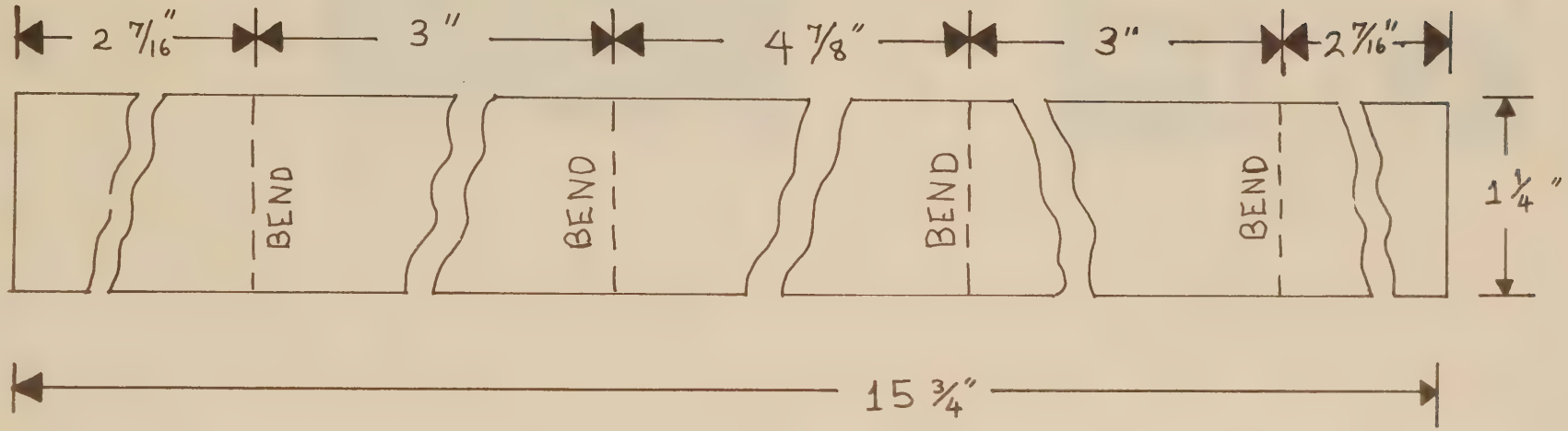


FIGURE 9 SHELL LIDS

FIGURE 8 OUTSIDE SHELL



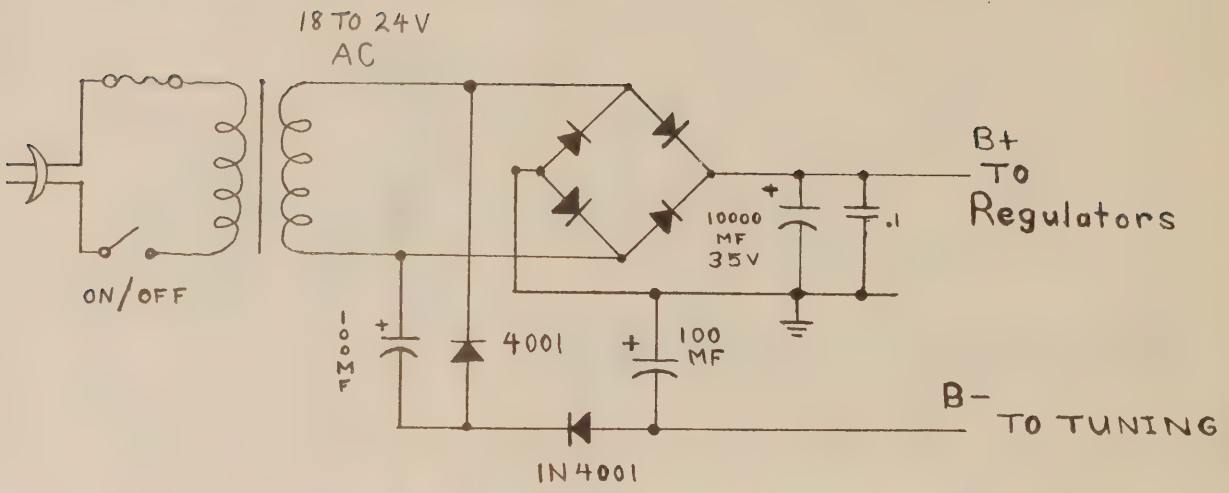


FIGURE 10 NEGATIVE VOLTAGE STEALER

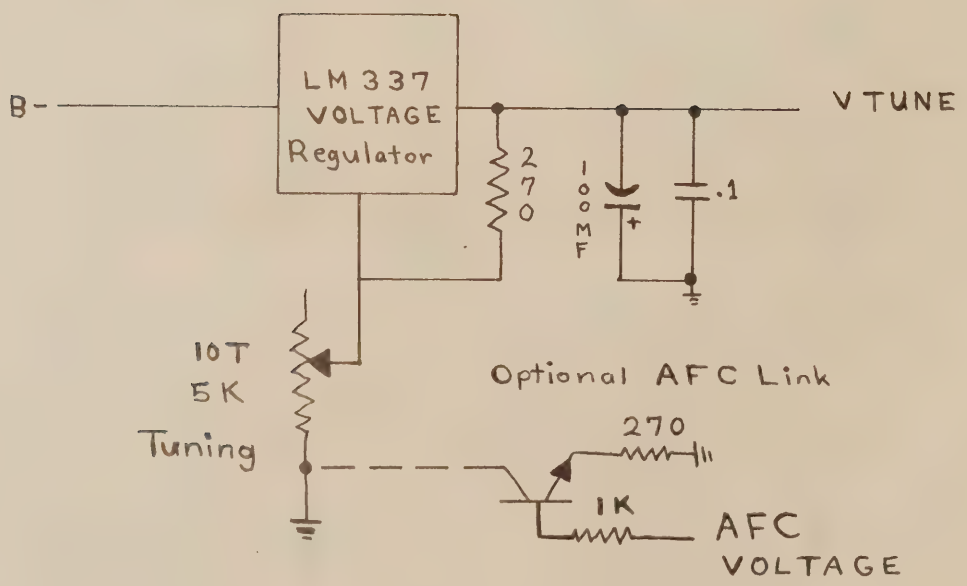


FIGURE 11 NEGATIVE TUNING SYSTEM

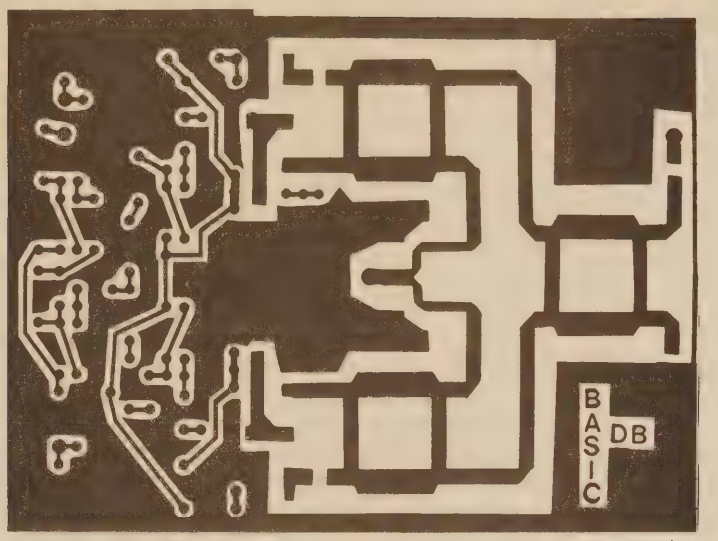
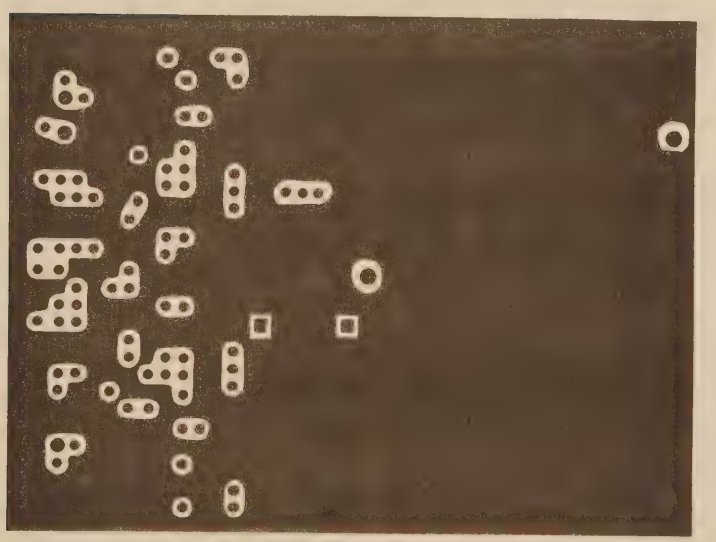


FIGURE 5 PC BOARD TOP

FIGURE 6 PC BOARD BOTTOM



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LETTERS

Dear John

I have finally gotten around to putting the information together on the KLM satellite receiver kit. I found a few key points missing from the manual which caused me to spend several hours on the alignment. It took ten hours to build and two months off and on to do a couple of hours of alignment.

First of all my kit was ordered mid October and was shipped four weeks later, which is when KLM estimated it would be shipped. The downconverter module was missing, and the large black weather proof cover was split up the sides. A phone call to KLM got a downconverter on its way, but I never did get a new cover.

Looking over the downconverter module, which is factory assemblied and tested, I noticed that the output 3 db T pad had a 1.2 K shunt resistor which didn't look right. It was factory tested so I left it alone. I later changed the 1.2 K to a 220 as the few ohms increase in impedance to the output MRF901 was enough to make it unstable and oscillate.

My kit was supplied with MWA210's for the IF gain blocks instead of the MWA110's. The big difference between the two is the MWA 210's are 10 db amplifiers where the MWA 210's yield 20 db less gain. Later telephone conversations with KLM revealed that the MWA 210's were not adequate for areas outside the stronger signal contour, and shipped five MWA 110's to replace the MWA 210's. I also learned that along with using the MWA 210's that two 6 db pads in the first IF module should be reduced to 3db pads. This will give 6 db more gain out of the first IF module.

The 0.15 Uh chokes for the first IF module were the large non molded style instead of the miniature style used in the rest off the kit. These didn't set down on the P.C. board, but set up in the air with approximately 1/4 inch leads. I later replaced these with the miniature molded style, and found the frequency response to be slightly different, but nothing that would degrade the performance.

I would recommend that after aligning each of the two IF modules that they be driven into compression and check the in band ripple or flatness. I found that my second IF module had approximately 2 db less gain at 60 mhz as it did at 80 MHZ. This was caused by having removed the output capacitor C 18, as instructed by the instruction manual that this could improve the skirt selectivity. Replacing the output capacitor flattened the compressed gain in band.

The manual indictes a 20 dbm level be used to align the video demodulator, and connect the scope to J2 to look at the S curve. In the system the output level of the second IF module limits or compresses around 8.5 dbm and this is the level into the video demodulator it should be aligned with. The S curve distorts as the drive level is varied up or down more than 1 - 2 db from the level used to align at. This alignment is best done by cascading the second IF module with the video demodulator and driving it into limiting, I used 13 dbm here.

I found that connecting the scope to the junction of C24 and C25 to be a better representation of the discriminator output than J2. This was verified by plotting the discriminator db output v.s. frequency. If you don't have the tuning voltage connected to C39, you will need to jumper between C39 and ground inorder to provide a DC return for the discriminator diodes.

The only problem I experienced with the finished unit after properly alignment was an annoying buzz in the audio caused from the video. This was caused by C34, a 0.39 uh tantalum, which was slightly reverse biased. I replaced it with a ceramic which cleared up the problem and improved the picture. Testing C34 didn't reveal any leakage or defects.

I replaced C34 with the ceramic part for two reasons, one was the voltage across C34 was less than a volt, and with temperature variations the polarity could reverse the other direction. The other reason is that tantalum capacitors should be operated with a DC potential close to their rating or they will deteriorate.

I did all of the alignment on my unit with the modules removed from the receiver assembly, this could account for the problem I encountered with viewing the S curve at J2. However if you use the junction of C24 and C25 you can't go wrong.

I will be glad to answer any questions that I can regarding the unit, however I must insist on a SASE with any correspondence.

I hope this information will be of help to some of the readers John, as it would have reduced the time I spent.

SINCERELY, Douglas Greenway
10313 Nita Pl N.E.
Albuq., N.M. 87111

505-299-8540 HOME
505-846-0377 WORK

ED:

I should have titled this as a KLM KIT REVIEW. VERY WELL DONE. It is also indicative of many calls I've gotten. Maybe you and the other KLM Kitters should Form A users group, Like us CPMers.

Dear Mr. Rohner:

Enclosed is my check for 1 yr. subscription. I have seen one of your magazine It looks very promising and it should have been started sooner, as information has been hard to come by. I hope that I get on your list as soon as possible. I don't want to miss your articles.

I have built essentially two receivers. The first is a prototype in a rack using plug in's. This was built in this manner so that substitution would be easy.

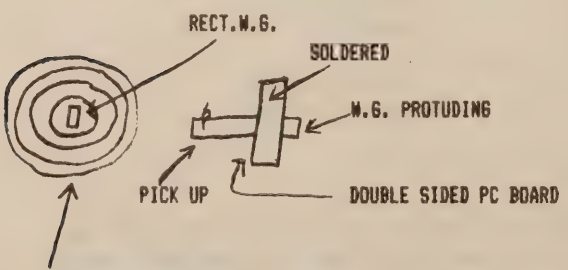
The 1st unit 900 MHz front end used a home built passive mixer IF amp used NEC MC 5229 amplifiers (2), one at filter input and the other on the filter output.

The filter was made on 1/16" G10 fiberglass using tuned lines of tinned copper stock optimum oper. was achieved by trail and error using tin snips and a Dremel rotary tool for trimming. A diode detector HP430C PWR meter 2-416 OSC beating together to form signal to drive IF strip, and perform other tests. For the 70 MHz IF amps I used 2 PA-19 preamplifier mfg by Digitrex Electronics (Royal Oak, Mich.) the filter coils etc were similiar to the T.Howard.

The 900MHz OSC was built using approx. 1 1/2" square PC board etched if cut with Dremel tool using MRF 901 as OSC, enclosing with shim stock and soldered to prevent radiation of signal. Incidentally this OSC worked as well in this receiver as the Avantek which was used later.

The demodulator origonilly was a 561 which was changed to a NE564 which works better. The demod was followed by an ECG 826 (IF amp. detector, audio amp in 1 chip). The video amp. used a 592 driving 2-2N2222 as clamp and video out. The preceding was used to check out the next receiver subassemblies before installing them (and to make improvements).

The LNA's were built using NEC GAS FETs, NE21889. The antenna was built first as a stressed dish which was not satisfactory, I was not able to get the proper curve within tolerance. I then rebuilt the antenna preforming the alum. radials etc. The feed was made from scrap alum. w.g. for which I fabricated a scalar feed, the w.g. was rectangular and I am not using any round w.g. (this may not be the best way to go but I took the easy way).



SPIRALs made from thin copper tin plated and soldered to PC board (The circles are round, carefully spaced).

I built this entire system, checked everything, aligned it on a satellite, received pictures without having any physical assistance. As you know getting an entire system to work and pointed correctly with none of the components previously checked on or with a working system was rough. The first bird was a Canadian, the sound had an extra tone that I thought, that my strip was oscillating. I had no idea that they were transmitting that signal.

I have a better working system with a magnum mixer, avantek vto's, better shielding, design changes etc.

I have tried the MC1357 in some ways it is better than the NE564. I am thinking about designing a delay line demod, to try.

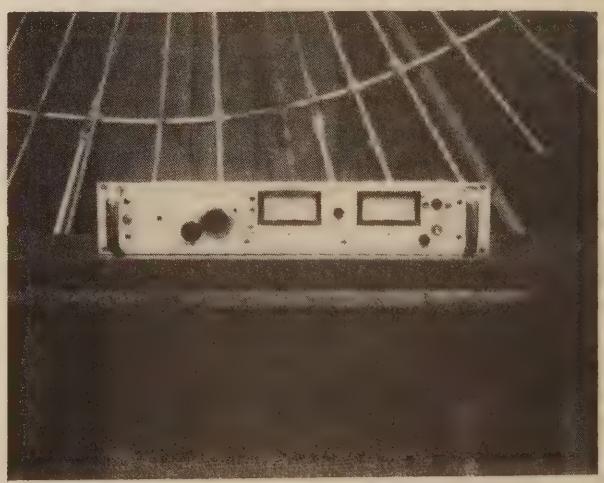
My present receiver allows easy substitution of assemblies which has been a big help to myself and other builds who are seeing their units working in my shop before they complete their units.

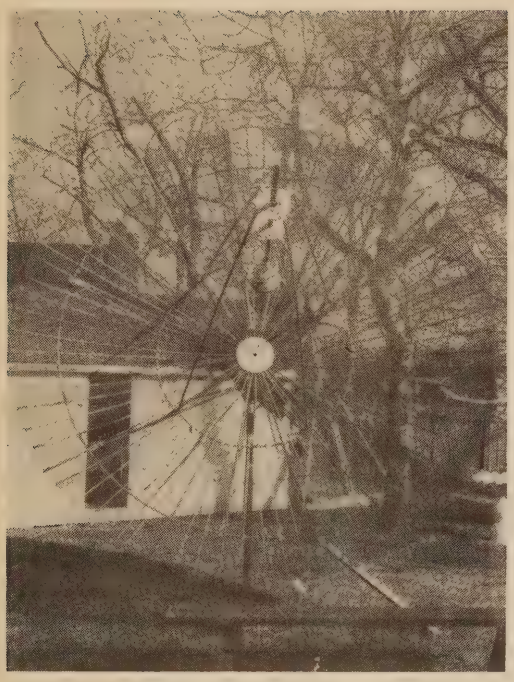
Enclosed is a couple of photos. (polaroid) To give you an idea of what is built.

Best of Luck to You and Your Magazine,
Erlin L. Freeman

ED:

Heres one home builder thats done about everything the hard way and learned. Then did it again using what he learned. GOOD SHOW.





Mr Rohner,

Yes, I want a subscription to your new magazine (I don't like Coops Digest either). I would also like to know the name and the address of the Electronics Magazine referred to in your newsletter under DIGITAL TV. I would like to learn more about that subject.

Also I am sending you this Feedhorn Design that I got out of the Howard Manual, Its for a Parabolic! Do you have one for a spherical? He doesn't! Thank You. I'll be looking forward to the first issue of your new magazine.

Ernie Thompson

ED:

Electronics, P.O. Box 514, Hightstown, NJ. 08520. Cost is $18 per year. This publication is aimed at the professional engineering community and is a worthwhile investment for the library of those interested in whats going on in the field. It comes out Bi Weekly. With the subscription you will also receive a "DESIGNERS CASEBOOK" which has some usefull stuff in it.

I have not only seen it but have built and tested several versions off it. Do Not use double sided PC board. I don't have a version for a Spherical. Sorry

Dear Sir:

Please send me information on your satellite receiver and magazine.

I was listening but did not have an antenna up for 40 meters, but hope to remedy that today if weather permits.

Thank you
E.J. Ainsworth K5OPO

PS: I enjoyed the net very much and have question. I have a 12 foot dish with a 19 inch depth which I figure to be 5 foot and 2 inches focus distance. Would like your opinion of the dish. It's stamped on spun aluminum.

ED:

I wish to AGAIN invite all amateurs, or anyone, to tune in to the Ham Radio Satellite Users Net. It meets every Sunday At 14.310, plus or minus QRM, at 1 PM Central time. After the first hour we get into an informal session where we talk about new developments, Ken Raes new receiver PC board set etc., and try to solve some of the problems that are inherent to such things as the "Howard/Coleman" or 564 PLLs or home built LNAs or whatever. JOIN US.

The best analysis is the picture it presents. It sounds good.

John and Georgia,

I must say that I thoroughly enjoyed the complementary issue (DEC.) of the Satellite T.V.R.O. Digest that you sent me. Thank you very much. Enclosed is my check for $26.00 for a subscription to the Digest. I am assuming that January is a back issue now and have included an extra six dollars for it and November. I know that November is the first issue because I heard it on the HAM NET. I would also like to know how much it would cost to get the back issues of the RCVR Newsletter.

I have a couple of questions about the December issue. If you can't reply I understand. They are:

1) figure 6, page 6 seems to be missing?

2) line 16, right hand column, page 13-9/8"?

3) figure 5, and figure 6, page 24 seems to be missing?

4) line 23, and line 24, right hand column, page 27 -- look at the stripline presented this month for the 218 GASFET -- presented where?

5) line 3, and line 4, right hand column, page 30 -- but you might want to try the new California Amplifier, see ad. - ad. where?

I have included a SASE for you to use if you can manage a reply. I appreciate anything you can do for me.

I and a friend have built a 70 MHz oscillator that we can pull + or - 10.7 MHz or so. It does not have the most linear Freq. versus Cont. Voltage plot in the world, but we coupled it with a Composite Video Generator circuit we built and used it to test the 70 MHz part of the homebrew TVRO receiver I am building. Would you be interested in the circuit? No audio or dither yet.

Speaking of my TVRO receiver. I was using the "ol' divide-by-two NE564" bit until I saw the MC1357 circuit in this mag. I tried it and was pleased with the results. By the way, I've had a dual emitter follower at the output of my PLL in my receiver for almost six months now. I guess I shoulda' told somebody.

Well that's all for now. I gotta go eat lunch and half hour from now set up for receiver only on 14.310.

Thanks a Bunch,
Stan Heaphill

ED:

Yup we screwed up. Most of the corrections are in the Jan/Feb issue.

The whole idea of this publication is to pass on circuits that may be interesting to others. It may help someone else out so send in anything, including comments, that you think someone else might get something from. It won't hurt and if it helps just one person then its worth it.

I have heard from many people who have tried the 1357 Demod. The comment is usually the same as yours. That makes putting all the work that goes into this worth it.

I guess you should have told somebody. But lets face it up to now who? I go thru the same agony each month. Asking myself if I couldn't get just enough time, and mag. space to add one more project. I usually end up putting in what I get time to and what I get asked most often for. The Stripline got deleted by one such project and will be put in at some later date.

California Amp. finally did run their ad in this issue.

Dear Sirs:

So far I have written you twice. I find the field of Satellite TVRO Technology to be really fascinating. I have received your Aug./Sept., 1981 newsletter and just recently your December 1981 issue of Satellite TVRO Digest. Needless to say I am very impressed with your magazine. Its really what I need to know. I really enjoy reading it. So, as a result, find my check for $20.00 enclosed for a years subscription.

I do move around a lot, but you can send the magazine to the address listed on the subscription form. Would you be able to send me your October newsletter and November TVRO Digest? Also, If I'm too late on getting my subscription in for the January issue, would you please send that issue to me also?

Would you please answer these questions for me?

1) Will a 8 foot parabolic dish antenna and 120 LNA and your basic receiver work in Orem, Utah?

2) What is the threshold of "the basic"? (I assume it must be good from what I've heard.)

3) Are you going to publish a DE-SCRAMBLER for HBO?

Thank You,
Kevin Burnett

ED:

Back issues are now being sold for 5 dollars. We were back starting the new subscriptions to November but cost of reprinting has finally forced us to charge for them.

To answer your questions.

1) with 2 or 3 degree spacing looming on the horizon I am advising 13 foot dishes with 10 foot as a minimum. I think thats a realistic size to protect the investment. However there are similar systems to the one you describe running in several parts of the country.

2) The basic, or any other receiver I build, will be set up to "commercial" type standards. I'm not a believer in the 8 db claims made by some. Full quieting is at the standard 11 db point, our spec. I have seen receivers come thru and tweeked to as little as 7 db but thats electronics.

3) Probably.

tear out and return

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_____ $50 U.S. FUNDS enclosed. Outside above three countries

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Publisher: SATELLITE TVRO TECHNOLOGY P.O. BOX 318, WEST LIBERTY, IA 52776

COMSAT ACQUIRES AMPLICA

Comsat General Corp., a subsidiary of Comsat, has acquired Amplica, Inc., a California based manufacturer of advanced microwave amplifiers, by purchasing its outstanding stock valued at about $57 million.

With estimated 1981 revenues of $14 million, Amlpica manufactures a wide range of microwave amplifiers and related subsystems for defense electronics and commercial satellite communications equipment.

The company offers over 600 standard low-noise, medium-power and general purpose amplifiers.

According to Comsat General, the acquisition of Amplica was intended to complement the firm's involvement in the satellite.

SHOWTIME

Now that Showtime has hit breakeven, sources are encouraging speculation that it will field another service offer. A study group has been assigned, but decisions are said to be unlikely through 1982." There are niches," one executive said. "We'll consider one that's unfilled, or one that's now filled badly." The last time the network flirted with a second channel idea was 1979, when adult fare was the top contender.

RCAs SATCOM IV

RCA officials say they will decide "very shortly" on an alternative proposal for the allocation of transponders on Satcom IV. While refusing to be specific about when or what the announcement would be, RCA spokesman John Williamson said RCA would respond to the FCC's request for a new idea. The FCC earlier this month ruled that RCA's Nov.9 auction of seven of 24 transponders to the highest bidders was unacceptable because the bids, ranging from $10.7 million to $14.4 million were discriminatory. Satcom IV is expected to be ready for operation April 1.

THOSE GREAT OLDIES

The Entertainment Channel has acquired a two year exclusive on all 14 Sherlock Holmes films starring Basil Rathbone and Nigel Bruce.

Snydication contracts for the venerable package expire in June. TEC is expected to rest the films for six months or so and begin running them in January 1983. A spokesman for Leo Gutman, Inc., owner of the Holmes and Charlie Chan libraries, said the TEC license fee eclipsed the projected syndication value, but declined to provide a figure.

ESPN

Mizlou Television Network, the ad-hoc commercial television company, has agreed to simulcast its lineup of college football bowl games this fall with the Entertainment and Sports Programming Network. The one year partnership calls for Mizlou to broadcast seven games (Independence, Garden State, Holiday, Tangerine, California, Hall of Fame and Bluebonnet bowl) over ESPN, while retaining its over the air status. Mizlou will also simulcast other sports events with ESPN through mid 1982. ESPN President and CEO Chet Simmons broke the announcement in the course of an emotional defense before affiliate representatives here last week on the network's recent move to cut back local ad availabilities in prime time. "You must allow us to compete for events," he said. "Otherwise, pay networks, superstations, STV and others will prosper, and you'll have nothing at all to sell." Before answering criticism, Simmons revealed plans to add an additional two minutes in local advertising time per night, in set time periods before and after various programs. The spots will be set aside as program guide messages to accommodate affiliates not selling advertising. Despite the plan, several affiliate representatives questioned ESPN's move. "I'd wish earlier on, you would have been more responsive," one system operator said. "I don't understand why the avails were taken away before the fact.

DAYTIME UNDERWAY

Five companies have signed on a charter advertisers of Daytime, Hearst / ABC's upcoming women's programming service. Leading the pack is General Motors' Chevrolet division. The deal comes on the heels of GM's exclusive contract with WTBS for sponsorship of the superstation's NCAA college football package. college football package. Also on board with Daytime are Quaker Oats, Campbell Soup, Revlon, and for Manhattan viewers only, Manufacturers Hanover Trust. If successful, the Manufacturers Hanover campaign may be tailored for national play on the service. All five campaigns begin when Daytime launches March 15. Further details on the contracts were unavailable at press time, although Daytime officials were promising more advertisers on board by the end of the week. In another Hearst/ABC cable move, the Metropolitan Museum has made a program development deal with ARTS for performing and visual arts projects. Five hours of programming make up the initial phase, with two programs, THE 18 th CENTURY WOMAN, and CURATOR'S CHOICE, slated for this spring. The agreement is nonexclusive, permitting the museum to negotiate with other programmers, and ARTS to seek additional museum partnerships.

SENATE ON TV?

After two days of discussion, the U.S. Senate voted 92-3 to give full consideration to Majority Leader Howard Baker's Res. 20, which would allow for TV coverage of the Senate's floor proceedings. Debate and a vote could come as early as Monday, Feb. 8. But observers expect the margin to be much closer when the measure is finally moved. The resolution has been under the aegis of the Rules Committee since it was introduced by Baker last year. All along, the opponents, lead by Russell Long (D-LA) and John Danforth (R-MO) threatened to block its way to the floor. However, they were not among those voting against taking the measure to a final vote.

LOW POWER TV ADVICE

Low power television is alive and well, FCC Commissioner Anne Jones told luncheon audience at the first annual Low Power Television Conference and Exhibition. An Office of Management and Budget allocation of $500,000 will provide for 15 staff members and a mini computer to process applications. Funds won't be available until Oct. 1. The resurrected version of low power TV will undoubtedly be different than its incarnation under former FCC Chairman Ferris. When Ferris first introduced regulatory framework for the technology, it was intended as an opportunity for minorities and non commercial broadcasters to deliver specialized services to small broadcast audiences. That priority will remain, Jones said, but the licenses will be open to anyone, with some ownership limitations likely.

Former FCC Chairman Charles Ferris used his appearance before the 1982 Low Power Television Conference and exposition to deliver a scathing attack on Reagan administration funding policies.

Ferris termed current efforts to further trim the FCC budget "fiscal nonsense". "The FCC must operate under restraints greater than I or any of my predecessors," Ferris said, concerned that the impact of budget cuts on communications agencies could be devastating. Addressing the issue of LPTV, in particular, Ferris said the FCC will be unable to process the "thousands, even tens of thousands of applications" and recommended a lottery system instead of a comparative application process. Ferris said the administration is "blindly ignoring" the needs of the agency in order to proceed with its deregulation of telecommunications issues. Although he was not arguing against deregulation, Ferris said it could not be accomplished effectively without a thorough study of competitive impact."I am afraid they have a deregulators framework built on an imaginary foundation," Feris said.

FCC SAYS NO TO RCA.

As if it didn't have enough problems with the results of its recent transponder auction invalidated by the Federal Communications Commission, RCA Americom has been told it must continue to specify by tariff how it assigns its transponders on Cable Net I and II. RCA has been the only domestic satellite carrier required to include transponder assignments with its tariffs for the cable satellites. This requirement was imposed in 1979 because of the number of complaints the FCC had received about allocations.

RCA requested that the commission remove the requirement or impose it upon all domestic satellite carriers. The commission cited the controversy over transponder allocations during the past year as the reason for continuing the requirement which applies only to satellites used by the cable industry.

GALAXY FILLS SLOTS

Hughes Communications filled its last full time slots on Galaxy I last week, taking on the Spanish International Network (SIN). Earlier, SIN charged Hughes with backing off on a $14 million deal for two transponders in favor of a third party agreement (reportedly with ABC). As part of the agreement, SIN will drop its Federal Communications Commission petition filed in December, and will not reveal the transponder price.

Commenting on the change of heart, SIN Executive President Andrew Goldman said, "Hughes came back and said, "Lets talk. Come on out here and we'll negotiate the deal." End of story."

Hughes did so, but after the third party talks broke down, according to one company official." Let's just say the situation between us and SIN was an interlude, "the source continued. "We wouldn't have negotiated with them if the relationship was severely strained. "Like four of its five fellow holders of Galaxy I space Time Inc., Westinghouse, Turner Broadcasting and Viacom, SIN declined to reveal transponder plans. The fifth, Times Mirror, has publicly suggested its two Galaxy slots would carry Spotlight.

The satellite is scheduled to launch in May 1983, with 18 of the 24 slots accounted for.

In an unrelated development, SIN will offer live coverage of this summer's World Cup Soccer Championship from Spain free to all cable operators. SIN plans to televise live and same day taped coverage of all 52 matches in the event.

ARIANE

In the few weeks since the fourth and final test flight of Europe's ARIANE rocket, plenty of evidence has accumulated that lift off will be translated into payoff. Ariane is basically a Franco German project, although it has been operated by the European Space Agency, which is backed by 11 member states. It's cost them an estimated $850 million since 1983. But interest in Ariane is much wider.

At the time of the final launch, there were 27 firm orders for satellite launchings and 16 options for the same. Ariane will be used to put up all Europe's communications and maritime satellites in the ECS and Marecs series. At the end of December, ESA signed with Western Union to put the Westar VI satellite into orbit in 1983, sharing the launch with a French telecommunications satellite.

The fourth flight from Kourou, in French Guiana, took up Marecs A, the first of two maritime communications satellites built for ESA and leased to Inmarsat, the 36 nation International Maritime Satellite (INMARSAT) Organization. Marecs B will follow in the late spring of this year. British Aerospace Dynamics Group (Space & Communications Division, Gunnele Wood Road, Stevenage, Herts, England) is leading a consortium of European aerospace organizations as prime contractor for Marecs. Marconi Space & Defense Systems is responsible for the communications payload, with contributions from Aerospatiale, ETCA, L.M. Ericsson, Thompson CSF, LCT and Hughes Aircraft.

Marecs can handle more than 35 shore to ship and 50 ship to shore voice channels at the same time, and any one voice channel can be used for 22 telex circuits.

British Aerospace is also building five models of the European communications Satellite (ECS), of which Marecs is a derivative. The first ECS will be launched this year. The contract for L-SAT, ESA's large multiroll satellite with direct broadcasting capabilities, timed for 1986, has also gone to British Aerospace.

HTN PLUS A REALITY

With help from parent company Westinghouse, Home Theater Network named a launch date and transponder last week for its maxi pay channel, HTN Plus. The service's 12 hour daily combination of family movies and travel specials will premiere March 1 over Satcom IIIR, transponder 16, leased by Showtime and Appalachian Community Service Network. HTN Plus will program four movies per day Sunday through Friday, with an additional feature on Saturday.

An HTN executive confirmed that Group W handled negotiations with Showtime for the transponder, But would not reval the cost of the agreement. The result has forced another service using the transponder, the Christian Media Network, off the air.

C-SPAN EXPANDING

On February 1, John Saeman, chairman of the board of the Cable Satellite Public Affairs Network, pushed four buttons on his telephone, activating the tone decoders at cable systems across the country. The result was that many systems switched over to transponder 19 on RCA Americom Satcom IIIR -- the new 16 hour a day home for C-SPAN

For the next month, C-SPAN can be viewed on both transponder 9, which it leases from USA Network, from 10 a.m. until 6 p.m. and on transponder 19 from 10 a.m. until 1 a.m. After April 1, C-SPAN will only be transmitting on transponder 19.

DBS SEEKING BIDS

Satellite Television Corp. has invited five U.S. satellite manufacturers to bid on the construction of two high powered direct broadcast satellites to be used by the Comsat subsidiary for its planned satellite to home pay television service.

It issued its requests for proposals to Ford Aerospace & Communications Corp., General Electric Co., Hughes Aircraft Co., RCA Astro Electronics, and the TRW Systems Group. All proposals are due by April.

The RFPs covered specifications, testing and product assurance programs.

Satellite Television Corp. which a year ago submitted to the Federal Communications Commission its proposal for a $683.5 million subscription television service, said one of the two satellites would be used to initiate the satellite to home pay TV service to an area roughly equivalent to the Eastern time zone of the U.S. The remaining spacecraft would be used as a spare.

Responses to the RFPs also must provide options for the additional satellites needed to complete the firm's planned nationwide direct broadcast satellite service.

Construction on the spacecraft would begin immediately after FCC approval of the firm's DBS application.

Because the construction program is expected to take more than 3 years, the firm said DBS service would become available in late 1985 or early 1986, if the FCC approves it.

The satellites will have three operating transponders, each with a radio frequency output of about 20 to 40 times higher than that of conventional satellites now serving the U.S., approximately 200 watts. The birds are expected to provide at least 1,700 watts of prime power so the signal can be received by small receiving antennas, generally 2.5 feet in diameter, that will be located on individual subscribers' homes.

According to the company, subscribers would receive the scrambled signal via a decoder channel selector.

SATELLITES IN DANGER

U.S. satellites should be made to function independent of human ground control because of the vulnerability of the nation's space systems used for defense, according to the director of the DOD's advanced projects agency.

The aerospace industry must intensify work in on board data processing and computation and robotics to increase the U.S. space system's survivability and reaction time. This is the view taken at a recent American Astronautical Society meeting by Robert S. Cooper, head of the Defense Advance Research Projects Agency (DARPA).

Current spacecraft are operating with "retarded technology," Cooper said to the gathering of the scientific society.

The former director of NASA's Goddard Space Flight Center said, "We have built this fatal flaw into our satellite systems, and it's time we recognize the fact." He called for defense, industry and NASA to coordinate strong space technology development efforts that include more than individual projects.

This must be done, he added, to achieve the advances needed for survivability and data efficient military spacecraft.

THE NEEDED COMMITTMENT

There is an existing though little stated committment between the Defense Department and NASA that cannot be broken and should be further exploited, according to Cooper. For instance, defense intelligence spacecraft using technology inherent in the Landsat spacecraft's digital image capability and the Seasat radar imaging spacecraft could revolutionize the concepts of warfare in the 1990s.

Conversely, Cooper said, developments as a result of current defense programs could help develop less expensive scientific satellites and space craft.

SPACE SHUTTLE IS KEY

The space shuttle is a key to the creation of a more efficient and survivable satellite system used for defense. It is the low cost of placing satellites in orbit and repairing them once they are up there which makes the shuttle attractive.

"Exploiting the space shuttle means achieving standardization in spacecraft so that such a launch system can help save costs," he said. A multi-mission spacecraft design is therefore needed, Cooper added.

Defense interest in space systems has risen steadily over the past few years. But the call for increased use of space for military purposes in the latest Federal budget has focused attention in the area.

According to Cooper, the formation of space policy is an area where the nation has the potential of "making the biggest mistakes with the smallest number of words."

It is the highly structured and specialized projects of the past that have driven up the costs of the space systems and obstructed the path of the deployment of advanced space systems.

COKES MOVIE COMPANY

Coca Cola decided to mix soft drinks with movies when it bought Columbia Pictures for $900 million last week. And, just about everyone agrees the purchase will make movie making a little sweeter for Columbia.

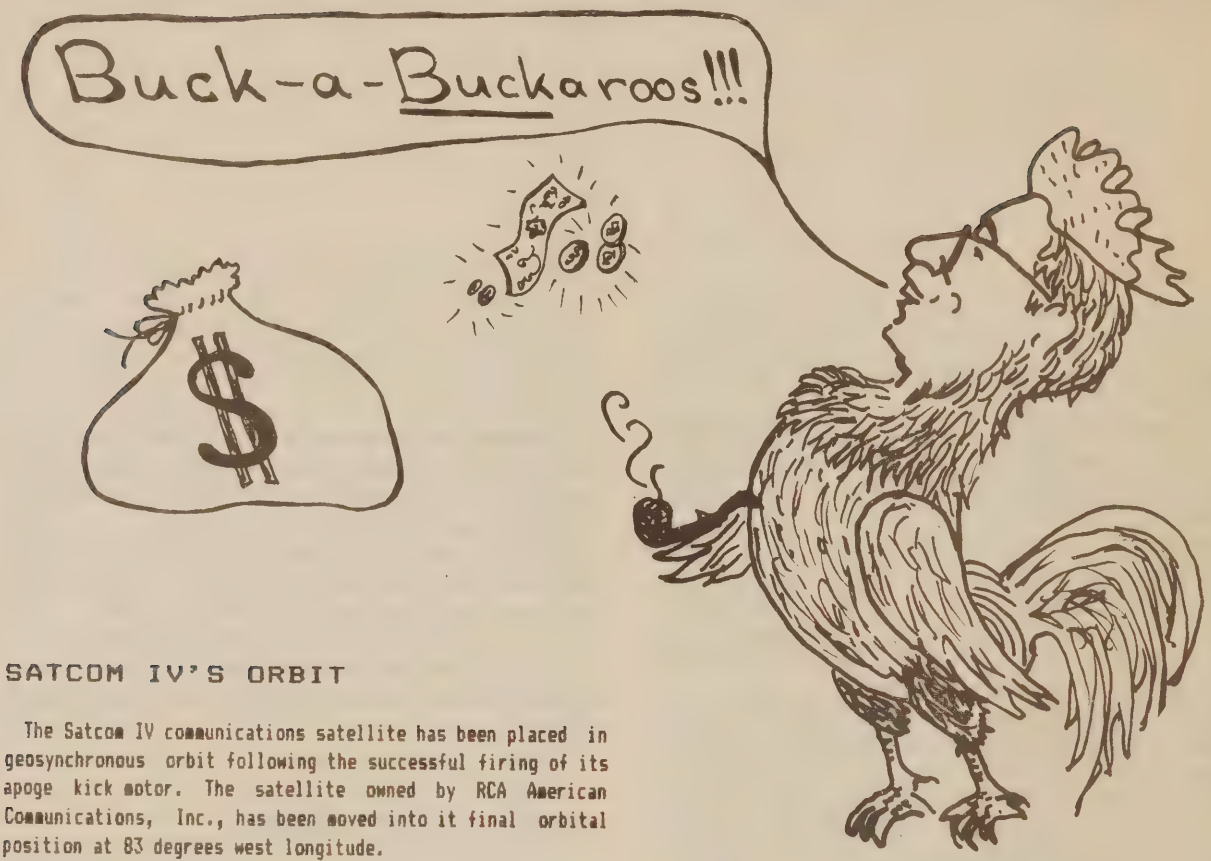
Columbia is the fourth motion picture studio purchased in the last year. Denver oil magnate Marvin Davis bought Fox for $800 million. Metro Goldwyn Mayer bought United Artists for $380 million. And just last week, A. Jerrold Perenchie and television sitcom producer Norman Lear bought AVCO Embassy for $25 million.

COUNTRY MUSIC

After several months of deliberation, NLT Corporation, a Tennessee holding company, and Group W Satellite Communications have announced plans to produce and distribute the Nashville Network, an advertiser supported satellite delivered country music channel slated to debut in the first quarter of 1983.

The Nashville Network is a project of Opryland Productions, a division of NLT Corporation's broadcasting and entertainment affiliate, WSM Inc. The network's programming will be produced by Opryland Productions. Group W will be responsible for the advertising, sales, marketing and distribution of the service. The two companies will share the advertising revenues; however, company officials noted that the revenues will not be split 50/50.

The country music service will initially program 12 hours per day, (eventually 24 hours) of "foot stompin' finger pickin' country sounds" via Westar V, the Western Union satellite scheduled to launch late this year.



SATCOM IV'S ORBIT

The Satcom IV communications satellite has been placed in geosynchronous orbit following the successful firing of its apoge kick motor. The satellite owned by RCA American Communications, Inc., has been moved into it final orbital position at 83 degrees west longitude.

DIRECT BROADCAST BIRD

A move to build the nation's first direct broadcast satellite (DBS) for commercial use is now underway.

The Satellite Television Corp., a subsidiary of the Communications Satellite Corp. (COMSAT), has invited five U.S. satellite manufacturers to bid on the development of the high powered DBS bird. The satellite will be used for satellite to home pay television service.

According to Satellite Television Corp., the company has issued requests for proposals (RFPs) to six firms. These are: Ford Aerospace and communications General Electric, Hughes Aircraft, RCA Astroelectronics and the TRW Systems Group.

The RFP encompasses six exhibits including specifications, test product assurance programs and various other contract requirements. The REPs were issued under confidential disclosure agreements.

Satellite Television's satellites will operate in the 12 and 17 GHz bands for uplink and downlink. There will be three operating transponders, each with an RF output power off about 20 W. This level is approximately 20 times higher than that of a conventional communications satellite.

Each of the two spacecraft called for in the RFP will put out 1700 W peak power, and will used a shaped beam antenna to cover an area roughly equivalent to a time zone. This coverage is known as the satellite's "footprint." It is expected that home antennas will be generally about two and one half feet in diameter.

WESTAR WANTS TO GO.

Word from Western Union officals is that the satellite carrier wants an earlier launch date for Westar V, now scheduled for liftoff September 30.

With Western Union itching to join RCA and Hughes as transponder sellers, the company recently asked the National Aeronautics and Space Administration to provide a stepped up timetable. NASA officials reportedly proposed a May launch. WU rejected the offer, holding out for June at the earliest, August at the latest. By the end of the month, Western Union may know how early they can reach for the stars. Meanwhile, the reach for checkbooks of program suppliers and transponder hopefuls will have to wait for the FCC's decision on selling slots, postponed again.

LEXINGTON

Lexington Broadcast Services' video division has formed a satellite fed program supply service for strand alone pay services and subscription television outlets. Known as the LBS Entertainment Network, the service will distribute one music special per month beginning March 5, with a live concert by the Pointer Sisters from Los Angeles. The special will be distributed to affiliates via Westar III, transponder 7.

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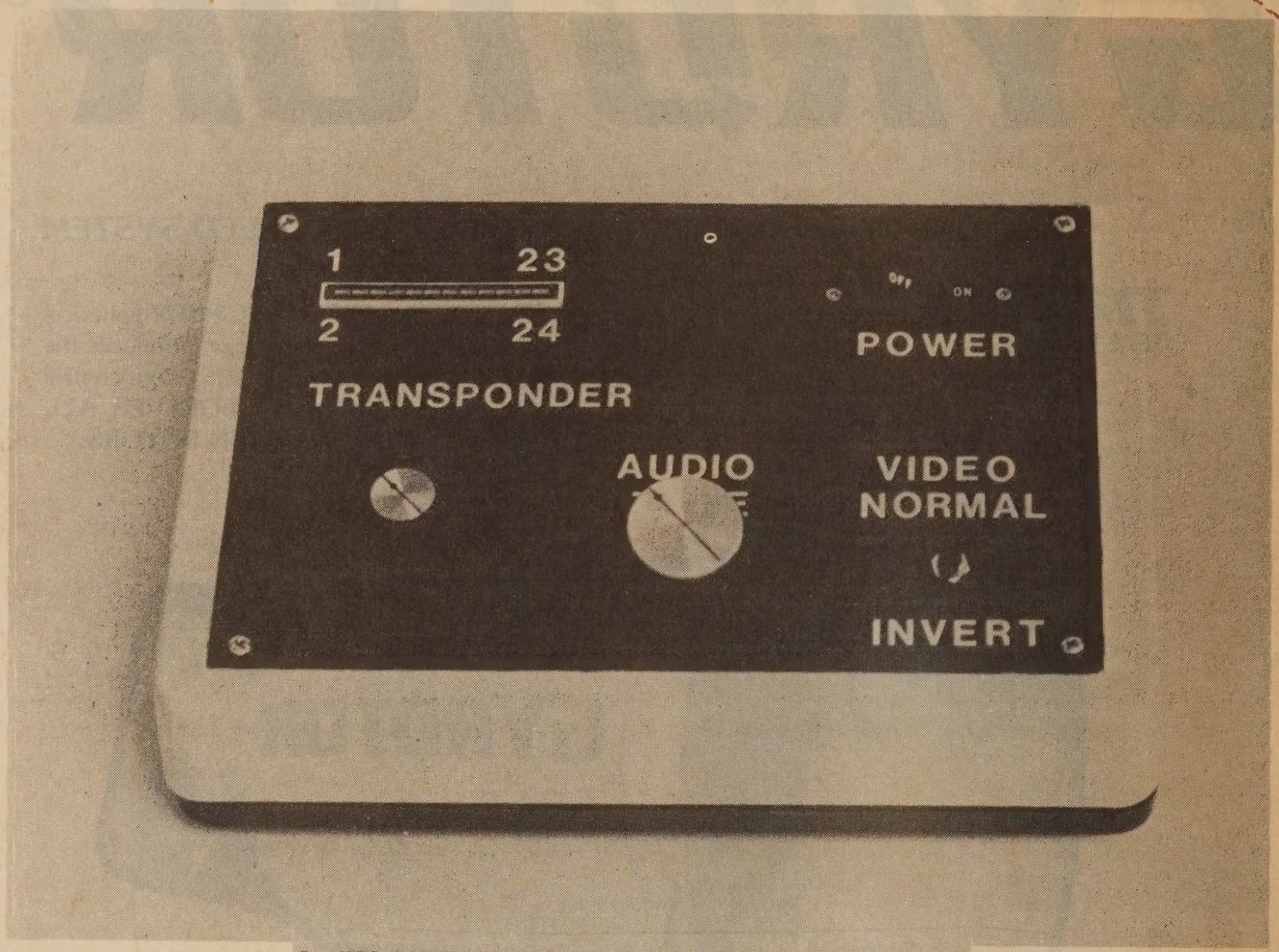

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